DECEMBER 1927—THIRTY-FOURTH YEAR

MACHINERY

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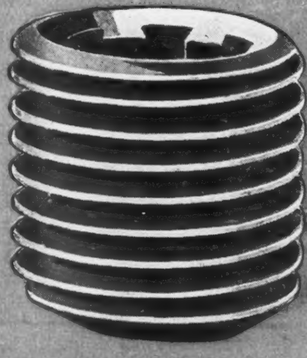

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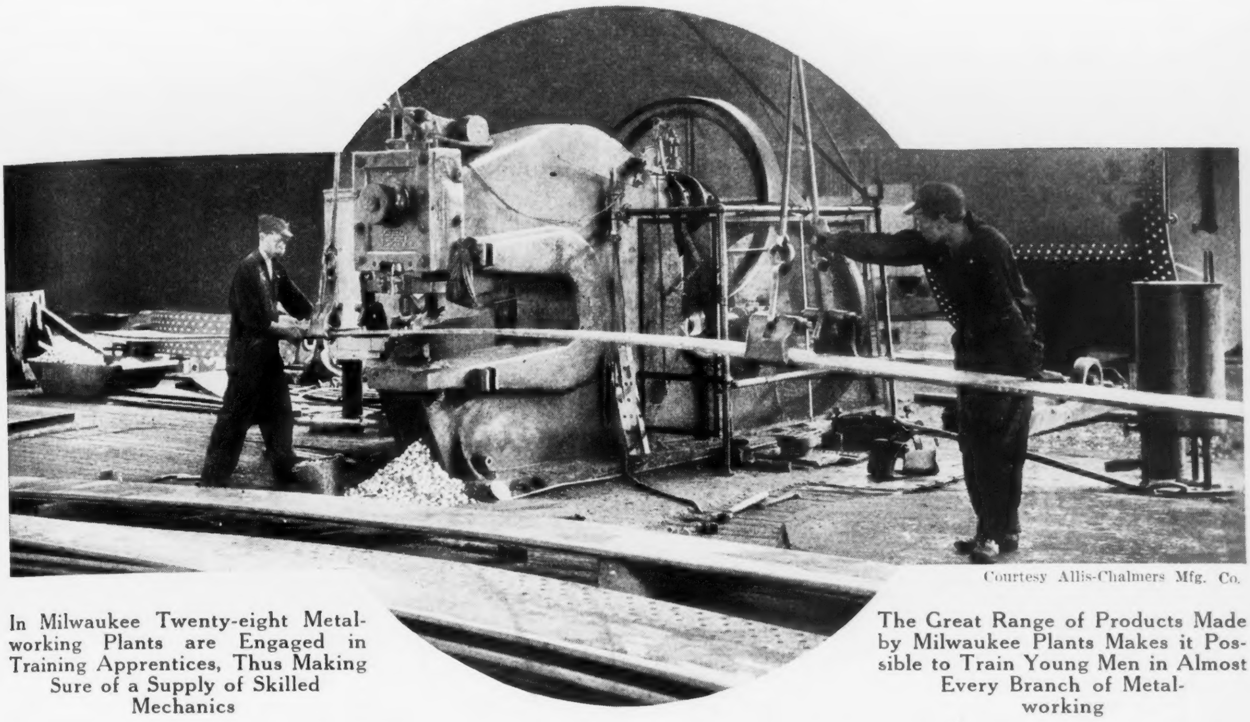


Courtesy Allis-Chalmers Mfg. Co.

In Milwaukee Twenty-eight Metal-working Plants are Engaged in Training Apprentices, Thus Making Sure of a Supply of Skilled Mechanics

The Great Range of Products Made by Milwaukee Plants Makes it Possible to Train Young Men in Almost Every Branch of Metal-working

Results of Milwaukee Apprenticeship Plan

By C. J. FREUND, Apprentice Supervisor, The Falk Corporation, Milwaukee, Wis.

THE program of apprentice training carried on by the Milwaukee branch of the National Metal Trades Association is expected, before many years have passed, to supply all the skilled men required in this district by the metal trades. It is the aim to provide not only mechanics, but also inspectors, foremen, draftsmen, and even engineers and shop executives.

The metal trades comprise the largest industry in Milwaukee; in some phases, this industry is as large as all others combined. The most influential shops, employing a total of over 20,000, are members of the association. Twenty-eight of these plants are actively engaged in training apprentices. The production ranges from the largest hydro-electric machinery to the smallest hand tools, and obviously requires a great variety of skill. At the same time, this condition provides an excellent range of apprentice experience in each trade in which training is available.

At the present time, apprenticeships have been established for blacksmiths, boilermakers, coremakers, draftsmen, electricians, machinists, molders (both steel and gray iron), patternmakers, stationary engineers, toolmakers, and diemakers. Arrangements are frequently made by which deserving young men can take a combination course in two or more of these trades.

C. J. FREUND received his A. B. degree from Campion College in 1916, and then enrolled in the College of Engineering of Marquette University, from which he received his M. E. degree. He enlisted in the United States Army in 1917, where he was soon promoted to the rank of First Lieutenant. In 1919 he returned to Marquette University, and entered a cooperative engineering course, graduating in 1922. Mr. Freund next started working in the foundry of the Falk Corporation, and was, successively, chain man, timekeeper, heat pourer, and labor foreman. Since 1925 he has been in charge of the Falk apprentice department. He is a member of the American Foundrymen's Association and an associate member of the American Society of Mechanical Engineers.

C. J. Freund

The Milwaukee Plan is Based on a Sound Principle

The Milwaukee plan of apprentice training is based on the fundamental principle that all the companies in a district are jointly responsible for the development of skilled men. The members of the National Metal Trades Association in this community long ago discarded as ineffective and unfair the old haphazard methods whereby some shops train apprentices and the remaining shops hire mechanics in the open market without making the slightest effort to train them.

The association holds that the training of a sufficient number of mechanics for the industry is a community responsibility and that each plant must share this responsibility approximately in proportion to its employment of skilled men. A practical application of this principle is not easy, and, in fact, a number of manufacturers belonging to the association and employing a total of about 2800 men have not yet begun the training of apprentices. However, practically all have accepted the idea in principle.

The owner of the small shop and the specialty shop has almost invariably maintained, and with justice, that he is not equipped for complete trade training and that a young man could hardly claim to be an all-around mechanic after spending four years in his shop. The answer is that it is not necessary for an apprentice to spend his entire time in any one plant. He may be transferred from one shop to another during the course. These shops may all do special work, but he can learn the work done in each shop and when the apprentice course has been completed, he will have acquired a sufficient variety of experience in the different shops to fully qualify as a mechanic.

Three Important Factors Have Made the System Successful

Three important factors have had much to do with the success of the Milwaukee system. In the first place, manufacturers have taken a real interest in apprenticeship. They have not merely endorsed the movement graciously, but have actually worked at the problem and worked hard.

Second, the apprentice courses themselves are good. They are the result of years of study, and have been carefully adapted to suit the majority of young men. The proportion of the various operations in each course is as nearly correct as circumstances permit, and changes are made often enough to prevent monotony. Adequate theoretical instruction is given.

Finally, an organized program of publicity has impressed the people of the community with the sincerity of the metal trades industry in its training activities. Manufacturers who employ apprentices are no longer suspected of exploitation, and young men see opportunities in apprenticeship courses. In the office of every apprentice supervisor in the district may be found waiting lists of young men, even for foundry training courses.

The Training is Not Confined to Ordinary Machine Shop Practice, but the Patternmaker's, Molder's and Allied Trades are Completely Taught. Views Show Boys at Work at the Allis-Chalmers Plants

The Milwaukee Plan of Apprentice Training is Based on the Fundamental Principle that all the Manufacturers of the City are Responsible for the Training of Skilled Men for the City's Industries

With these ideas in mind, the members of the National Metal Trades Association in Milwaukee have enthusiastically taken up the training of young men for their industry, and their efforts have brought them no small measure of success. Although they feel that a mere beginning has been made, they employ 944 apprentices at the present time.

Considerable attention has been paid to the development of foundry apprenticeships. Countless shops may be found in which apprenticeship courses for machinists, patternmakers, and draftsmen have been established for years, but where no attempt has been made to induce young men to learn the trade of the molder or the coremaker. After studying the problem carefully, Milwaukee manufacturers have found that a desirable type of young man will go into the foundry if adequate courses are provided. These manufacturers point to 115 regularly indentured molder and coremaker apprentices, although they admit there should be many more.

Real Interest is Evidenced by Executives

The genuine interest which the metal trades executives in this community have taken in apprentice training has been demonstrated time and time again by the excellent attendance at apprenticeship meetings and by the eager contribution of ideas on the part of those present. But these men have not stopped at discussion; they have studied and experimented, solved each problem as it arose, adjusted conditions in their establishments so as

to make apprentice training feasible, interested young men in taking the courses, and finally trained them.

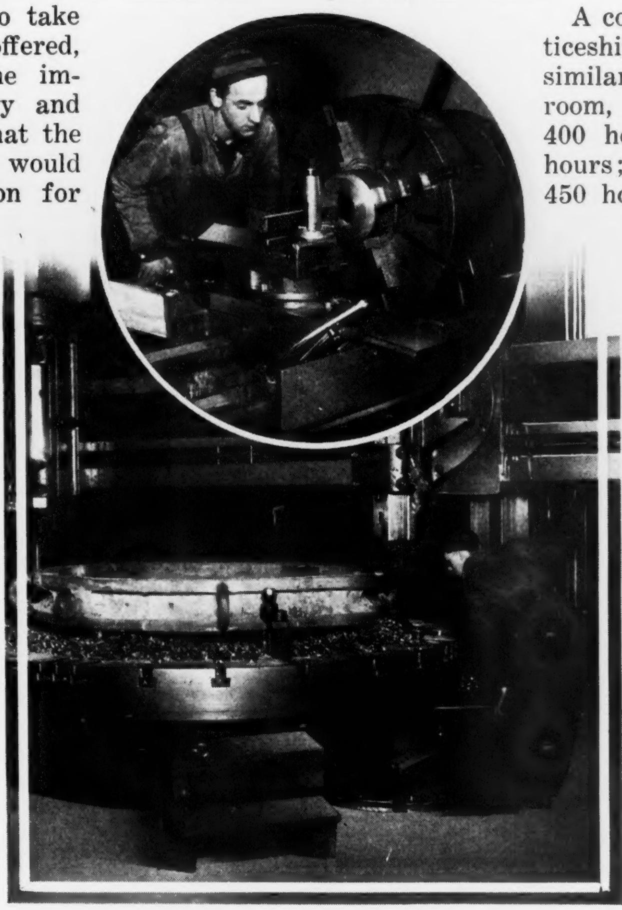
This interest has been brought about largely by conditions. Many years ago these men realized that mechanics were getting older and scarcer and knew that something would need to be done to provide skilled help for their industries. The obvious solution was to train such men, because if the manufacturers would not train them, who would? They soon realized, in addition, that effective apprenticeship is the best foundation, together with a good education, for the development of executives.

As young men began to take advantage of the courses offered, the manufacturers became impressed with their energy and ambition, and soon felt that the welfare of the boys alone would be a sufficient justification for apprenticeship, regardless of the need for trained men. A further consideration that presented itself as time passed was the value of apprenticeship in the development of high-grade citizens and a stable population.

The Courses are Thoroughly Planned

Mere enthusiasm on the part of the manufacturers and executives would have accomplished little, however, if this enthusiasm had not resulted in a careful study of conditions and well-organized courses of training. The work schedules of the apprenticeships are the product of a careful study of apprentice programs of all trades and ages; of a thorough understanding of the disposition and character of modern boys and young men, derived from conferences with school authorities and years of experience with juvenile employment; of a complete analysis of modern trade and industrial requirements; and of countless suggestions from the superintendents and other shop officials of the different companies.

Apprentice courses have been developed not only to meet the requirements of industry, but also to fulfill the needs of boys of various ages and educational accomplishments. Thus, within the trades already enumerated, there are four-year courses for eight-grade graduates; three-year courses for high-school graduates; and two-year courses for graduates of colleges and universities. Moreover, there are special courses of various kinds for adults who have determined to learn a trade after spending a number of years futilely drifting from one common labor job to another, without making any progress.



Apprentices at Work in the Plant of the Falk Corporation

Standard Rates of Pay and Uniform Work Schedules Have been Adopted in the Different Shops

Standard rates of pay and practically uniform work schedules have been adopted for the apprentices of all shops. The regular machinist apprentice contract of four years for eighth-grade graduates is divided into eight pay periods of 1220 hours each, and the following hourly pay rates are in effect: first period, 18 cents; second period, 22 cents; third period, 23 cents; fourth period, 24 cents; fifth period, 26 cents; sixth period, 28 cents; seventh period, 30 cents; and eighth period, 35 cents.

A contract for such an apprenticeship would require a program similar to the following: Toolroom, 250 hours; drill press, 400 hours; screw machine, 400 hours; shaper, 450 hours; planer, 450 hours, milling machine, 450 hours; small tools, 150 hours; turret lathe, 1200 hours; small engine lathe, 1200 hours; large lathe, 950 hours; small boring mill, 1200 hours; grinder, 350 hours; boring-bar, 350 hours; erecting, 600 hours; floor work, 350 hours; special work, 1010 hours. This gives a total of 9760 hours.

The three-year course for high-school graduates is divided into six periods, also of 1220 hours each. The wages range from 35 to 45 cents per hour. The work of these apprentices is divided into as many operations as the work of the four-year boys, but less time is spent on each operation. Four periods of 1220 hours each must be served by young men following the university-graduate courses, and these apprentices receive wages ranging from 45 to 55 cents per hour. The operations in this course are the same as in the other two, with the exception that tool-room, screw-machine, turret-lathe, boring-bar and floor work are omitted. Obviously, less time is spent on most operations.

Special apprenticeships are almost invariably planned to meet the peculiar requirements of the individual, and no attempt has been made to standardize them.

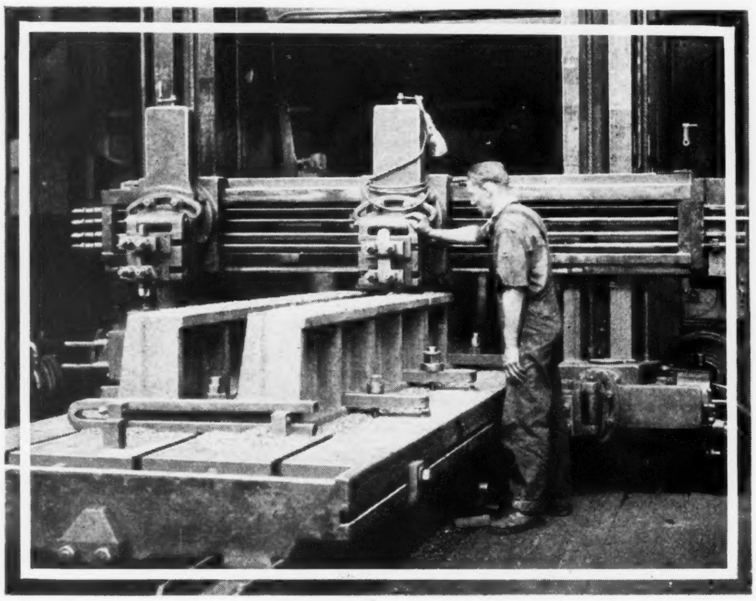
Apprentices are Often Shifted from Shop to Shop

Schedules of work such as outlined cannot be followed in every shop, because of special work and a limited equipment. Thus, Company X which manufactures heavy machinery exclusively from special designs has little production work, and the screw machine equipment in its plant is extremely limited. Company Y, on the other hand, produces lubrication systems, and there is not a single bor-

ing mill, planer, or other heavy machine tool in its shop.

When the apprentice supervisor of Company Y has determined that a certain apprentice in his employ is ripe for experience on heavy machine tools, he telephones to the supervisor of Company X and requests him to take this apprentice into his shop and give him training on the big machines. The Company X supervisor then sends to Company Y, in exchange, one of his charges who has had thorough training in heavy work and who needs to learn something about the quantity production of small parts. On the day agreed upon by the supervisor, the two apprentices enter a new environment and begin a new phase of their experience. In this manner, the plant with limited facilities does its share toward the training of apprentices for the district.

Theoretical instruction of apprentices is adequately taken care of by the Milwaukee Vocational School, which has an attendance of about 25,000, including the pupils of the evening courses. The apprenticeship law of Wisconsin requires that the apprentice attend a vocational school one-half day per week until he has completed 400 hours of school work. The National Metal Trades Association in Milwaukee has recommended that this school attendance be continued during the entire apprentice course, and practically all plants have complied with the suggestion. The classes at the school are organized for individual instruction of the apprentices, permitting each boy to advance as rapidly as his ability permits, and the results have been highly satisfactory.



A Machinist-Apprentice in the Allis-Chalmers Plant

Supervision of Apprentices

The supervision of apprentices in the plants is considered an important part of shop administration, and is usually assigned to a man who devotes his entire time and attention to this task. Organizations that are too small to warrant the engagement of a full-time man for this work have given the supervision of apprentices to an official and have arranged his work so that he can properly fulfill this duty. The apprentice supervisors engage the apprentices, arrange their work in the shop, transfer them from one operation to another, help them to solve their difficulties, maintain their morale, and are in every way responsible for the apprentice training activities in the shops. Under the apprenticeship law of Wisconsin, the Industrial Commission of the state exercises a general supervision over apprentice training.

Publicity Fosters Community Interest

When the metal trades shops first undertook their organized apprentice training activity, a vigorous program of publicity was necessary in order to attract sufficient boys to the plants. This publicity is still carried on to attract the better classes of young men, although each plant has a waiting list. The methods used are changed frequently in order to keep public interest alive. Manufacturers are frequently quoted in the local newspapers as being in favor of apprenticeship. The newspapers have been impressed by the earnestness of employers in this work, and have been glad to publish feature articles on the subject. Speakers representing the metal trades have appeared before high-school assemblies, teacher organizations, civic groups, and other important bodies, in the interest of apprentice training.

Exhibits of apprentice work have been held in connection with conventions of manufacturers and technical societies. The metal trades have taken part in exhibitions of apprentice work arranged by the Industrial Commission at the annual State Fair, which is well attended. Mass meetings of apprentices and their parents have been addressed by prominent men on subjects relating to apprenticeship, and vaudeville shows have been staged with apprentice talent. An annual banquet is given for apprentices, foremen, and executives.

During the last few years much of the publicity has been taken care of by the boys themselves. They are enthusiastic about their work and give glowing accounts of their progress to friends, parents, and former teachers.

Trade Contests Attract Attention and Create Interest

Organized competition in trade skill for apprentices has been adopted recently as an excellent means both for obtaining publicity and for maintaining the interest of the apprentices. A contest is being held at present in the shops of the Milwaukee Vocational School for machinist apprentices. A committee planned a series of problems in tool grinding that would tax the skill of a good apprentice in many different branches of machine work. The contest was announced from the office of the National Metal Trades Association, and each plant was permitted to enter one apprentice for each twenty-five machinist apprentices or fraction thereof on the payroll.

Each contestant marks his work with a number instead of his name, and when all have had their

turn, a committee will select the best three jobs and cash prizes will be awarded to the successful contestants. Apprentices participated in last year's molding and patternmaking contests conducted by the American Foundrymen's Association. These contests have played no small part in keeping apprenticeship before the public.

The apprenticeship affairs of the National Metal Trades Association are handled by committees appointed by the officers, a general apprenticeship committee of five executives directing the work. This committee meets several times a year and studies the business conditions of the industry, its growth and development, changes in the life and habits of the people, and new manufacturing methods. General apprenticeship policies are established in compliance with the results of the investigations. It also receives reports from and issues instructions to an operating apprenticeship committee.

The operating committee is composed of about twenty apprentice supervisors appointed by the chairman of the general committee, and meets regularly at least once a month. This committee carries out the decisions of the general committee and makes its own decisions in individual cases in compliance with the policies that have been established. It carries on the publicity work, contests, banquets, and other events, and the members assist each other in the solution of the problems that arise in their plants.

Satisfactory Results Have Been Achieved

All this activity has not been in vain; in the largest plant in the district, no foreman or other shop executive has been engaged for a number of years who has not been a graduate of an apprentice course in that shop. One manufacturer has not hired a single molder for either the steel or gray iron foundry for over two years, other than his own apprentice graduates. A number of plants have once and for all declared their independence of employment agencies.

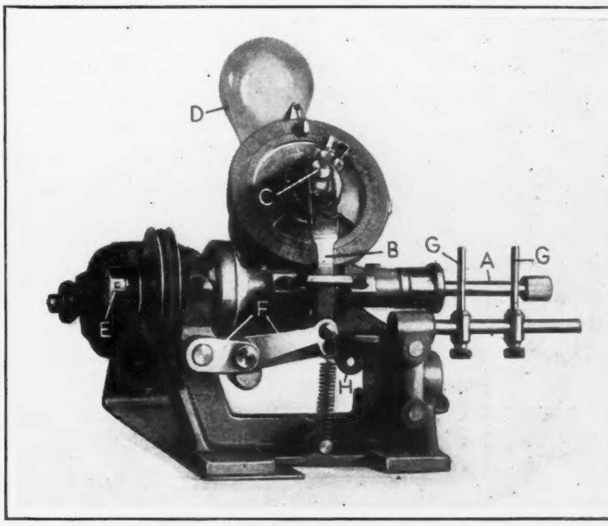
W. J. Fairbairn, secretary of the National Metal Trades Association in Milwaukee, estimates that 15 per cent of all the men employed in the local shops are skilled mechanics. He also has figures which prove that the average mechanic remains about twenty years at his trade. Accordingly, about one-twentieth of the skilled mechanics in the district must be replaced every year. Of the 22,200 employes in the district, the 15 per cent who are skilled mechanics number more than 3000. The twentieth part of this number, which must be replaced every year, is about 150.

At present there are 152 apprentices in the district who are in the last year of their course, which makes it appear that the need for skilled workers in the Milwaukee metal trades has been fully met. However, this is not yet the case, because in no previous year have there been so many apprentices on the point of graduation, and it will take a long time to make up for the shortage due to many years of inadequate apprentice training. Again, the industry is growing, and more and more mechanics will be required, in spite of the increased application of automatic machinery. However, the results are gratifying and encourage further effort.

WINDING COILS FOR RADIO EQUIPMENT

Coils of wire for transformers, coupling units, and other parts employed in radio equipment can be wound to predetermined lengths with the machine here illustrated. This machine is a recent development of the Viking Tool & Machine Co., Inc., 745-59 Sixty-fifth St., Brooklyn, N. Y., and is equipped with the stop counter manufactured by the same company, which was described in March, 1927, and December, 1926, MACHINERY.

In using the machine, the empty spool or part on which the wire is to be wound is slipped on spindle *A*; then latch *B* is lifted and the upper end slipped over plunger *C*. The machine then runs until spindle *A* has made the predetermined number of revolutions required to wind the desired amount of wire on the work. Just before the operation is completed, the red light *D* lights up to warn the operator to be ready to replace the work.



Machine Designed for Winding Small Coils of Wire to Predetermined Lengths

When the predetermined number of revolutions have been made, latch *B* slips off the plunger, and the machine stops simultaneously. By simply depressing clutch-actuating lever *H*, the machine can be stopped instantly at any point in its cycle. When the machine is being reloaded, the operator turns the two worm-wheels of the stop counter back to zero, but it is not necessary for him to watch the device, since the wheels are locked automatically when they reach the starting position.

The equipment is driven through a grooved pulley mounted loosely on shaft *E*. Power is delivered to this shaft when a friction clutch is entered in to the right-hand side of the pulley as latch *B* is raised, movement being imparted to the clutch through linkage *F*. When latch *B* drops, the clutch member is pulled to the right, and then functions as a brake to stop shaft *E* immediately. On this shaft there is a worm which engages the two worm-wheels and thus imparts movement to these wheels until they reach the position which indicates that spindle *A* has made the predetermined number of revolutions. This spindle is inserted into a socket in the right-hand end of shaft *E*. The upright bars *G* serve to guide the wire on the work. A mechanism may be provided for reciprocating these bars so as to feed the wire on the work at any desired helix angle.

Manufacture of Sewing Thimbles

By FRITZ HEIDINGER, Mechanical Engineer, Western Electric Co., Chicago, Ill.

THE dies and devices described in this article are employed in the production of thimbles used in sewing. The shape of the work after each consecutive operation up to the seventh may be seen in Fig. 2. Other operations, as shown in Figs. 8 and 9 (pages 256 and 257) are required to knurl the thimble and stamp little depressions into the end, as shown in the enlarged half-section view, Fig. 1.

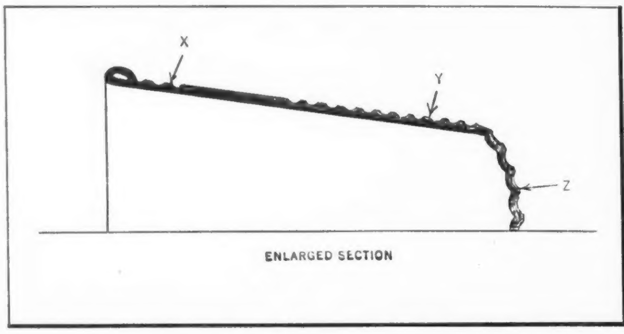


Fig. 1. Enlarged Half-section of Sewing Thimble

The diameter of the blank *A*, Fig. 2, is 1 1/2 inches, and the area 1.767 square inches, including the part trimmed from the end in the fifth operation. The material from which the thimbles are drawn is sheet copper, 0.0140 inch thick. A limited number of thimbles are made from silver of the same thickness, in the same dies. The presses used are of the inclinable type.

The die used for the first operation is shown in Fig. 3. The material is fed to this die in strip form, the blanks being cut out and drawn to the shape shown at *B*, Fig. 2. The piece is removed from the punch by the blank-holder *B*, Fig. 3, and from the die, by the knock-out pin *C*. The diameter of the die equals the outside diameter of the drawn cup.

The die shown in Fig. 4 reduces the diameter approximately 20 per cent. The work is placed on the blank-holder *E* by the operator. The press slide descends far enough to permit the cup to be stripped from the punch by the spring-actuated strippers *F*. The cup remains in the hole *G* of the die until the next piece of work passes out through the die and slides through a large hole in the back of the press. Thus the operator is not required to remove the work. The blank-holder is operated by a spring pressure attachment. The diameter of the die in this case also equals the outside diameter of the cup, and the diameter of the punch is the same as the inside diameter of the cup, which is shown at *C*, Fig. 2.

The die used for the third operation, shown in Fig. 5, resembles the one used for the second operation. It consists primarily of the parts *I* and *K*. The small strippers are so arranged that the work is removed at once after each down stroke. The diameters of the punch and the die are equal to the inside and outside diameters of the cup, respectively. These dimensions make no allowance for clearance. The dimensions given at *D*, Fig. 2, apply to the inside diameters.

In Fig. 6 is shown the forming die used in the fourth operation. This gives the lower part of the thimble its final shape. When the operation is completed, the stripper *M* lifts the cup so that it may easily be removed by the operator. The knock-out pin *N* is provided to eject the work from the die.

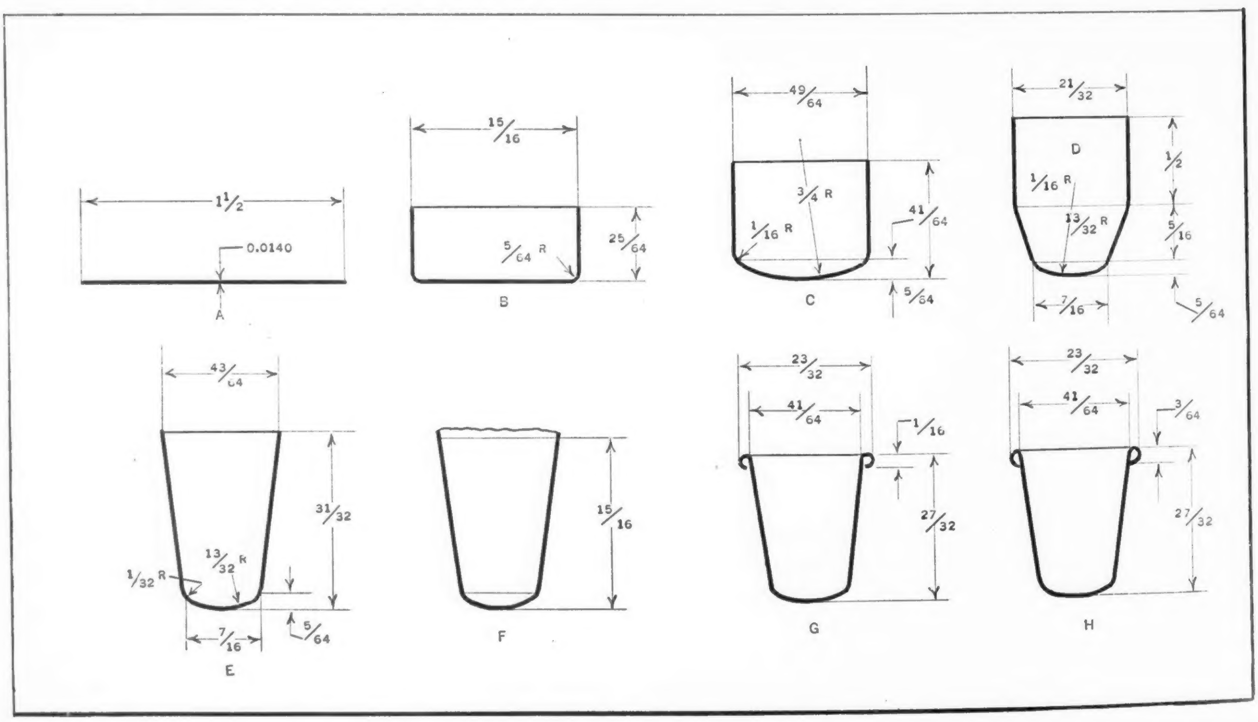


Fig. 2. Shape of Work after Each Consecutive Forming Operation

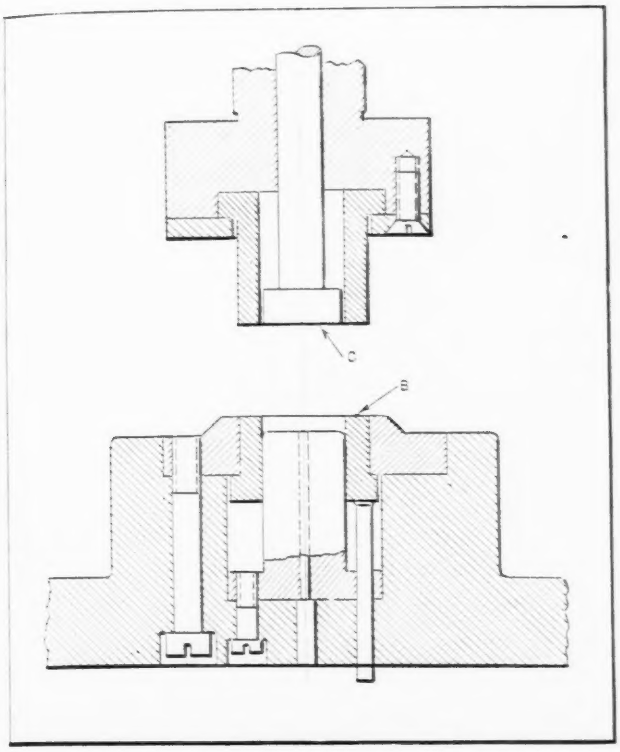


Fig. 3. Blanking and First Forming Operation Die

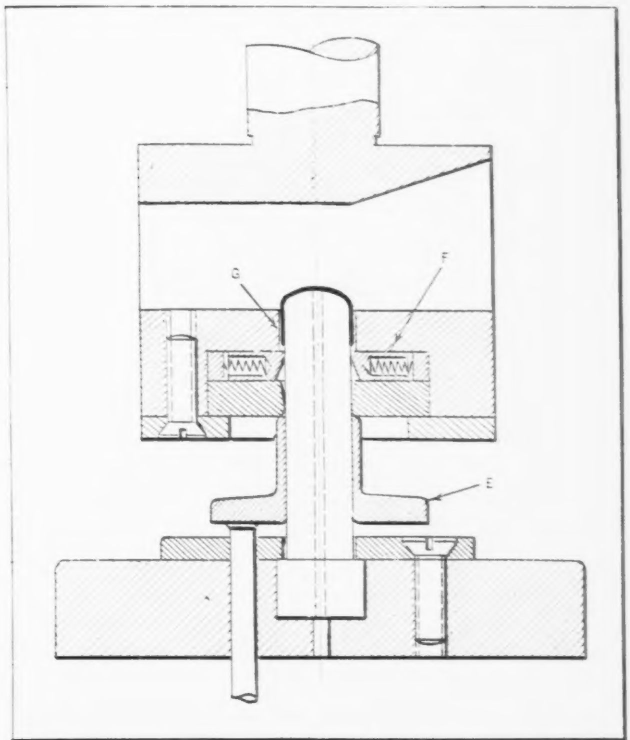


Fig. 4. Die for Drawing Work to Shape C, Fig. 2

As a preparation for the following operation, the cup *F*, Fig. 2, must be trimmed. It is, therefore, placed on the arbor *P*, Fig. 8, which is held in the chuck of a trimming machine and revolved at high speed. The stop *Q* holds the work in place while it is being trimmed to length by the knife *R*. The inward movement of the circular knife or cutter *R* is effected by means of a foot-treadle. The work is held in a similar manner for the rolling and curling operations.

From the trimming machine the cup goes back to the press, where the trimmed edge is curled in the die shown in Fig. 7 to the shape shown at *G*, Fig. 2. The work is placed on the holder *T*, Fig. 7, and the curling operation is performed by the die *U* when the press slide descends. The work is removed from the die by the pin *V*. The finish-curling operation is performed as shown in view *B*, Fig. 8. The roller *W* used for this purpose has a groove that produces the required roll or curl, as shown at *H*, Fig. 2.

A screw press is employed for stamping the depressions on the bottom of the thimble at *Z*, Fig. 1. These depressions show up somewhat, on the inside of the thimble, while those at *Y*, which are obtained by knurling, do not change the appearance of the inside of the thimble. Generally, an artistic design is knurled on the thimble at *X* close to the curled edge. A cylindrical roller (which is not shown) is employed for this purpose, if the design is narrow as compared to the length of the thimble. If the design is comparatively wide, a roller of conical shape must be employed, as shown in Fig. 8. The taper and the circumference of the roller are the same as for the thimble, so that the peripheral speed of both is the same at all points.

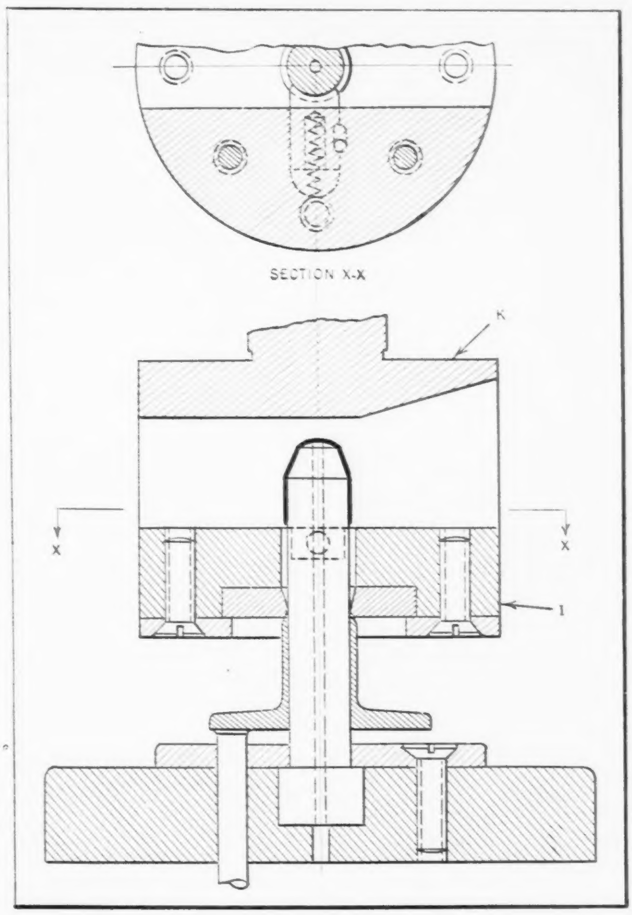


Fig. 5. Forming Die for Producing Cup D, Fig. 2

The last operation consists of knurling the thimble at *Y*, Fig. 1, on a special machine. The engraved roller for this operation is shown in Fig. 9. It will be noted that this roller has a slightly curved surface. The roller-holder *A* is forced against the work by a toggle link, and is backed up by a strong spring. This arrangement makes it possible to adjust the pressure and allow the necessary play for the roller. In addition, the holder is given a circular movement, as indicated by the arrow *B*. The different

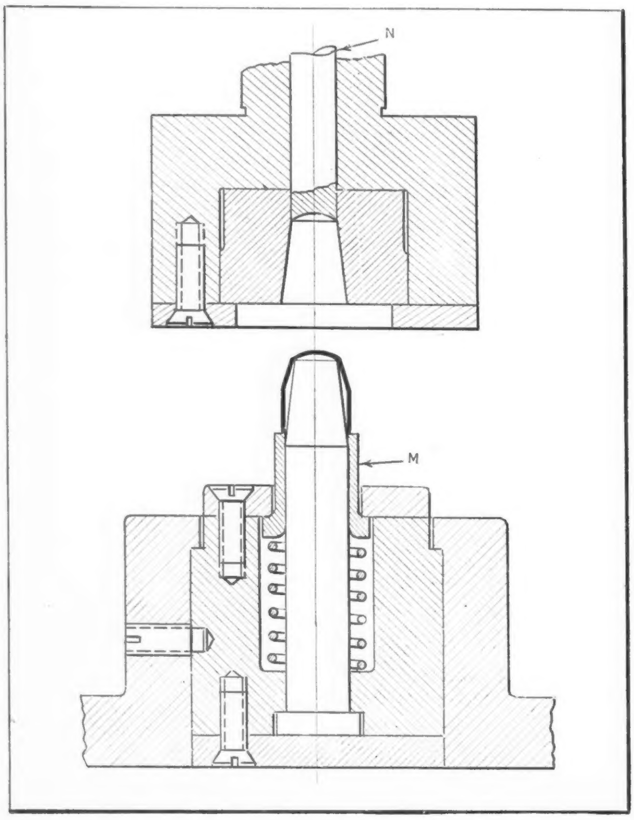


Fig. 6. Die for Producing Shape Shown at E, Fig. 2

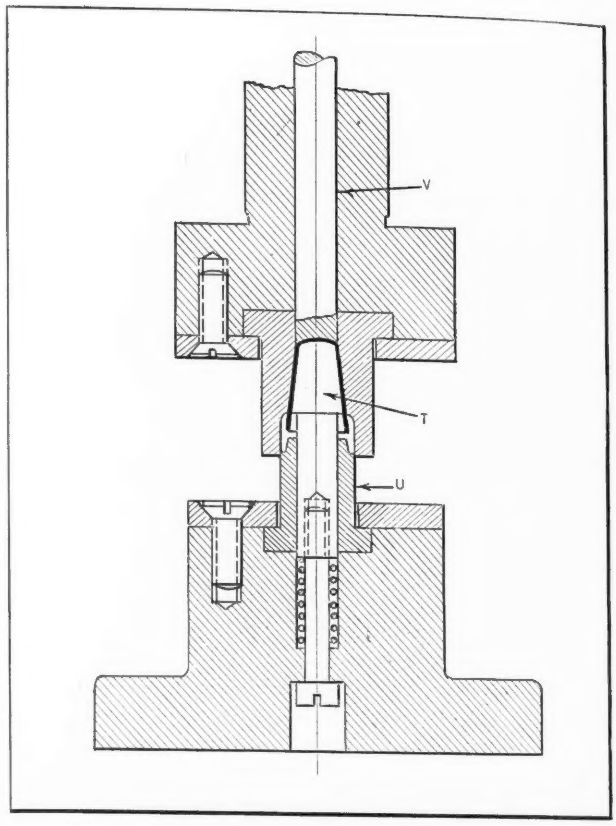


Fig. 7. Die for Curling Edge as Shown at G, Fig. 2

points on the roller are thus brought into proper contact with the work by the circular movement.

The work is held in place by a stop *C* having a point made of leather. The machine spindle revolves at high speed, and an automatic feeding device is employed, which gives an output of 2000 pieces per hour. Previous attempts to produce the required knurling with a straight roller pressed against the work failed to give satisfactory results. The thimbles made from copper are given a thin coating of silver after they have been completely formed.

* * *

A. S. T. M. STANDARDS

The American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa., has adopted not less than 515 standard specifications, methods of tests, and definitions of terms, covering almost every branch of engineering materials. Of these standards, 107 apply to ferrous metals and 70 to non-ferrous metals.

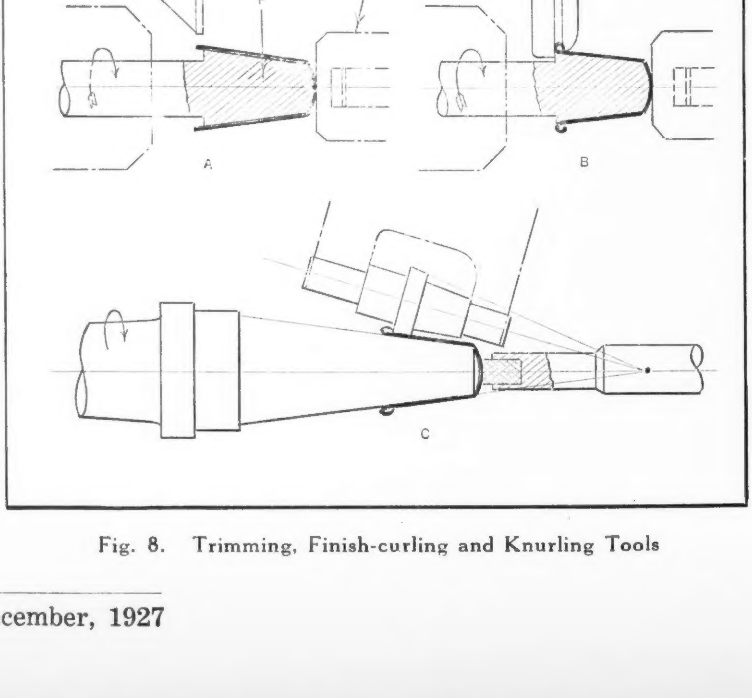


Fig. 8. Trimming, Finish-curling and Knurling Tools

MANGANESE IN STEEL

In the manufacture of steel, no satisfactory substitute for manganese has yet been found. According to *Engineering*, the shortage of manganese in Germany during 1917 and 1918 necessitated the trial of many substitutes, such as aluminum in the form of silicon-aluminum alloys. Aluminum has a greater affinity for oxygen than manganese, but the oxidation of aluminum produces alumina which is relatively infusible and often remains in the steel as slag inclusions. Aluminum cannot eliminate sulphur nor change the condition of sulphur, as manganese can. Furthermore, a slight excess of aluminum tends to produce large pipes in the ingots.

Silicon in the form of ferro-silicon probably has a greater affinity for oxygen than manganese, but its use is attended by the following disadvantages: In slight excess it causes large pipes to form in ingots; the products of oxidation remain

in the steel; it has no effect upon sulphur and no effect on the molecular arrangement of the metal. Ferro-titanium is the most powerful deoxidizer known. Titanium does not alloy freely with iron, and imparts to steel qualities that are not acceptable to the trade. Calcium, sodium, vanadium, and boron alloys have been tried as deoxidizers, but it has not been possible to produce homogeneous steel when they were used.

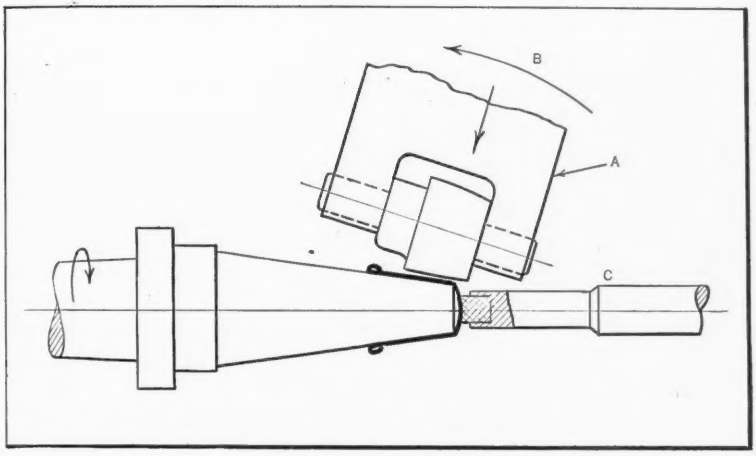


Fig. 9. Knurling Indentations in Thimble

* * *

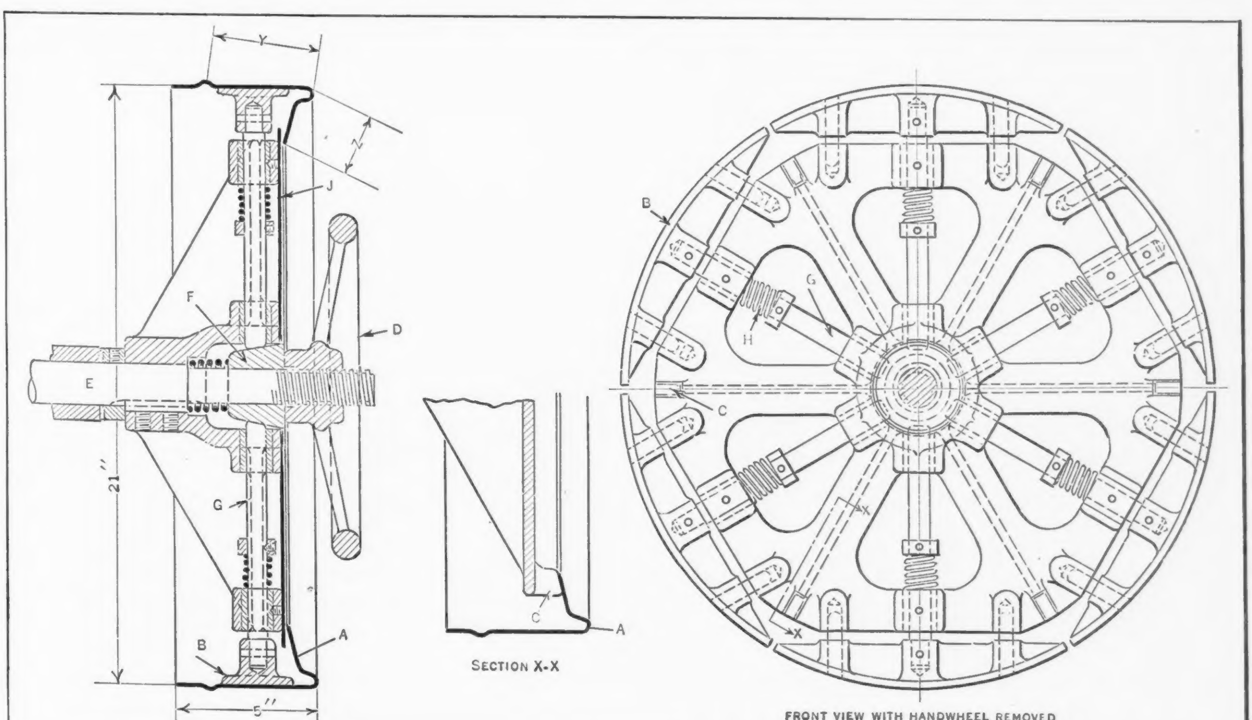
EXPANDING CHUCK USED IN BUFFING LARGE RINGS

Large pressed-steel or cast-aluminum rings, such as are used on washing machines, circular stoves, and barber chairs are automatically polished and buffed on machines built by the Automatic Buffing Machine Co., Buffalo, N. Y., which are equipped with chucks of the design here illustrated. The particular chuck shown was designed for handling ring *A* of a washing machine. The chuck is used both in polishing and buffing the rim and the face of the part. After the polishing and buffing operations, the ring is nickel-plated and then nickel-buffed. In polishing and buffing the rim, a wheel is applied, as indicated at *Y*, whereas in polishing and buffing the face, a wheel is applied as shown at *Z*. A right-angle attachment is employed in the operations on the face, and the wheels are formed to the outline of this surface.

The important feature of the chuck is the means employed for holding the work securely during the operation. This is accomplished by expanding six shoes *B* against the inside of the rim. First, the work is slipped over the contracted shoes until the inside of the face comes in contact with six stops *C*. Then handwheel *D* is tightened on the threaded end of spindle *E*, advancing the tapered collar *F* and pushing six rods *G* radially outward. This causes the shoes *B*, which are fastened to the outer ends of these rods, to be pressed against the work and thus hold it securely.

When the operation has been completed, handwheel *D* is turned in the reverse direction on spindle *E* to withdraw the tapered collar *F*. Springs *H* then function on rods *G* to pull shoes *B* from the work. Plate *J* prevents dirt produced by the polishing and buffing operations from reaching the chuck mechanism.

Chucks of this design can be used for various parts of approximately the same diameter, a movement of about 1/2 inch being imparted to the shoes. The application of this chuck to automatic buffing machines, for the operations mentioned, resulted in a production increase of 200 per cent over that obtained when the parts were polished and buffed by being held manually against polishing and buffing wheels.



Expanding Chuck Employed on an Automatic Machine for Polishing and Buffing Large Rings

Useful but Unpatentable Devices

Outstanding Examples of Invalid Patents on Combinations of Old Elements not Classed as True Inventions by the Courts

By LEO T. PARKER, Attorney at Law, Cincinnati, Ohio

PATENTS of important and universally adopted inventions have often been held invalid, although in many instances the inventions have achieved immediate and great popularity with the consuming public. This is particularly true with regard to mechanical patents. The purpose of this article is to review important cases that have been decided by the higher Courts involving the patents of inventions that have been held by the Courts to represent merely "aggregations" of elements, or unpatentable combinations of mechanical parts.

Manufacturers, engineers, and inventors will find the present article on what is and what is not patentable of considerable value and interest. The Courts have quite definitely established the principles upon which questions of patentability are to be decided. The author of this article quotes a number of examples of patents declared invalid by the Courts because they could not be classed as true inventions, being merely combinations of old and well-known elements. A correct understanding of the principles involved will often save needless expenditure of time and money in obtaining patent rights that may subsequently be declared invalid.

Aggregation of Elements is not Patentable

First, it is important to know that a "true combination" of elements is patentable, but a mere "aggregation" of elements is not patentable. To avoid an aggregation, the inventor must be certain that the invention comprises parts that co-act with one another so that the device produces a new result. It is immaterial whether the separate elements forming the combination are new or old; but it is indispensable the various elements co-act to effect new and useful results.

Also, it is important to know that the Courts have held on numerous occasions that the term "co-act," when used in connection with the elements of a patented device, does not mean that the parts must operate simultaneously; however, the action of each element must be necessary to effect some portion of the final result produced by the combined unit or mechanism.

Example Showing Importance of Joint Operation

Probably the most commonly known article, on which an invalid patent was thoroughly adjudicated, is the rubber-tip lead-pencil, in the case of Reckendorfer vs. Faber (92 U. S. 347.)

A careful review of the litigation involving this invention is important, because it was the first case of its kind to be decided by the Supreme Court of the United States. Moreover, after an immense sum of money was expended in an attempt to have the patent adjudicated as valid, it was held void. The comments of the Supreme Court in the opinion rendered in this leading case are today deemed the controlling law on the subject, and are cited by the foremost attorneys in patent litigations involving the distinction between true combinations and mere aggregations of elements.

The rubber-tip lead-pencil patent was granted on an invention comprising two elements, namely: a lead-pencil, and an eraser attached to one of its ends. Both the lead-pencil and the eraser had been used separately for many years previous to the date of the patented invention. In applying for a patent, the inventor claimed a combination of elements comprising the lead-pencil and the eraser.

During the litigation involving the validity of this patent, it was conceded that the arrangement of attaching an eraser to a lead-pencil added greatly to the convenience by enabling a person to erase a written mistake made by utilization of the lead end of the pencil; but the patent was held invalid primarily because the eraser does not co-act with the lead end of the pencil to produce a unitary result. In other words, each element may be used separately and independently of the other, and neither element depends upon the other.

In holding the patent invalid, the Court entered at great length into the details of the requirements of a patentable true combination of elements. The important parts of the opinion are as follows: "It may be safely said that no one is entitled to a patent unless (1) he has discovered or invented an art, machine, or manufacture; (2) which art, machine, or manufacture is new; (3) which is also useful; (4) which is not known or patented . . .

"This combination consists only of the application of a piece of rubber to one end of the same piece of wood which makes a lead-pencil. It is as if a patent should be granted for an article, or a manufacture as the patentee prefers to term it, consisting of a stick 12 inches long, on one end of which is an ordinary hammer, and on the other a screwdriver or a tack-drawer. It is the case of a garden rake, on the handle end of which should be placed a hoe . . . In all those cases there might be the advantage of carrying about one instrument instead of two, or of avoiding the liability of loss or misplacing of separate tools. The instruments placed upon the same rod might be more convenient than when used separately. Each, however, continues to perform its own duty, and nothing else. No effect is produced, no result follows, from the joint use of the two . . .

"The law requires more than a change of form, or juxtaposition of parts, or of the external ar-

rangement of things, or of the order in which they are used, to give patentability. . . An instrument of manufacture which is the result of mechanical skill merely is not patentable. Mechanical skill is one thing—invention is a different thing. Perfection of workmanship, however much it may increase the convenience, extend the use, or diminish expense, is not patentable. . .

"A combination, to be patentable, must produce a different force or effect, or result in the combined forces or processes, from that given by their separate parts. There must be a new result produced by their union; if not so, it is only an aggregation of separate elements. An instance and an illustration (of true patentability) are found in the discovery that, by the use of sulphur mixed with India-rubber, the rubber could be vulcanized, and that without this agent the rubber could not be vulcanized. The combination of the two produced a result or an article entirely different from that before in use. Another illustration may be found in . . . a saw-mill which advances the log regularly to meet the saw, and the saw which saws the log; the two cooperate and are simultaneous in their joint action of sawing through the whole log; or in the sewing machine, where one part advances the cloth, and another part forms the stitches, the action being simultaneous in carrying on a continuous sewing. In these and numerous like cases the parts cooperate in producing the final effect, sometimes simultaneously, sometimes successively. The result comes from the combined effect of the several parts, not simply from the separate action of each individual part, and is, therefore, patentable . . .

"In the case we are considering, the parts claimed to make a combination are distinct and disconnected. Not only is there no new result, but no joint operation. When the lead is used, it performs the same operation and in the same manner as it would do if there were no rubber at the other end of the pencil; when the rubber is used, it is in the same manner and performs the same duty as if the lead were not in the same pencil. A pencil is laid down and a rubber is taken up, the one to write, the other to erase with, or an eraser is turned over to write with. The principle is the same in both instances. It may be more convenient to turn over the different ends of the same stick than to lay down one stick and take up another. . . This, however, is not invention within the patent law. . . There is no relation between the instruments in the performance of their several functions, and no reciprocal action, no parts used in common . . . It is only an aggregation . . ."

Other Useful Developments not Classed as True Inventions

In Goodyear Tire & Rubber Co. vs. Rubber Tire Wheel Co. (116 Fed. 363), the patent was for a method of attaching an old and well-known rubber tire to a motor vehicle wheel by means of two wires attached to the tire so as to permit it to move slightly in its seat. The method of attaching wires to tires was old, but it had never been applied to this particular kind of tire. There is no doubt that this invention was a decided advance over the prior art, but there was no patentable invention involved, because the patentee merely located two old elements and combined them. Both performed the old function in the same way and independently of the other.

In holding the patent invalid for want of invention, the Court explained that it is easy to realize that the effect of combining the two most advantageous parts of all tire inventions would produce a better tire than had been previously constructed, but that such a device consists only of an aggregation of the separate elements.

A mere aggregation of well-known elements is not patentable. The different elements must work together in such a manner that the completed device produces a new result not formerly obtained by a combination of the elements that comprise the device. It is immaterial whether the separate elements that form the combination are old, but it is necessary that the elements be combined in such a way that they effect new and useful results. The working together of the elements is not construed by the Courts to mean that the parts must operate simultaneously; but in a patentable combination, the action of each element must be necessary to produce the final result obtained through the action of the mechanism as a whole.

Patent No. 134978 was declared void by the Supreme Court of the United States in the case of Palmer vs. Corning (156 U. S. 342), because the device, although valuable, did not represent a true patentable combination. The invention consists of a grate elevated above the top of the catch-basin of a sewer. The grate is supported upon pins located between the grate and the base ring, and between the pins there are spaces which allow the water to pass through. The purpose of the invention was to keep the openings in the grating free from the debris which would ordinarily accumulate on it.

In this patent, as in others previously mentioned, the elements when viewed separately involved no invention. A grate over a sewer was a well-known device, and the Court held that the mere use of a ring of iron upon which to rest the grating is obvious, and nothing more than a mechanical arrangement, which does not involve the inventive faculty. And, further, that the use of legs or pins was for the purpose of supporting the grate ordinarily. Actually the invention consisted merely of elevating the grate, as the same result would be accomplished with or without the use of the base ring.

In the patent the inventor explained his invention as follows: "My improvement consists in the employment of a device to elevate the grating a short distance above the opening that it covers, so that it will not become obstructed by small sticks, straws, leaves, and other rubbish not large enough to clog the sewer or drain with which it may be connected, and at the same time will stop all matter large enough to do injury in said drain."

During the litigation the patentee contended that although neither of the elements involved invention, yet when taken together they constituted a patentable "combination," by the use of which new and useful results were accomplished. However, the Supreme Court of the United States held

the patent void, and said: "We think it evident that there is no invention in the device now before us. It is claimed that its effect is to prevent the grate from being clogged. But this effect only comes from raising the grate and leaving openings beneath it . . . It seems manifest, indeed, that the only practical operation of this device is to increase the utility of the sewer by elevating the grate, and so rendering it easier for the water to enter."

Valuable Inventions May be Very Simple

Frequently inventors become confused and acquire a false belief that the terms "aggregation" and "simplicity" are synonymous; however, there is a vast difference between the terms. Many large and complicated machines have been held to represent an aggregation, whereas a valid patent may be obtained on a simple invention comprising only two parts, if it produces really new and useful results.

The language of the Supreme Court of the United States in Potts vs. Creger (155 U. S. 597) is deemed by leading patent lawyers to clearly express the modern law relative to the patentable invention. This Court said: "The apparent simplicity of a new device often leads an experienced person to think that it would have occurred to anyone unfamiliar with the subject; but the decisive answer is that with dozens and perhaps hundreds laboring in the same field, it has never occurred to any one before. The practiced eyes of an ordinary mechanic may be safely trusted to see what ought to be apparent to everyone . . .

Also, in Loon Co. vs. Higgins (105 U. S. 580) the Court said: "Now that it has succeeded, it may seem very plain to any one that he could have done it as well; this is often the case with inventions of the greatest merit."

Volume of Sales Does Not Indicate Patentability

At various times, in an attempt to have a doubtful patent held valid the patentees have introduced testimony to prove to the Court that a large number of the patented devices have been sold. However, it is important to know that where a patent is undoubtedly invalid the evidence of large volume of sales has little or no influence on the Court; but where invalidity of the patent is doubtful, such evidence may be convincingly in favor of the patentee.

For example, in Voigtmann vs. Weis & Ridge Cornice Co., this point of the law was involved, and the Court said: "The argument . . . in favor of patentability based on the utility, public acceptance, or magnitude of sales of the patented article, is appropriate in cases of doubtful invention, and sometimes is sufficient to turn the scale."

* * *

INSPECTING WORM-GEARS

In a paper by George H. Acker, chief engineer of the Cleveland Worm & Gear Co., read before the Montreal meeting of the American Gear Manufacturers' Association, it was pointed out that, with the exception of very large worms and some of unusual design, it is customary to grind the worm thread on centers. The bearing seats are also ground on centers. Special gages must be employed to insure concentricity of worm threads and bearing seats. The same instrument may be employed for gaging the size of the worm. On multiple-threaded worms, it is necessary to insure a high degree of accuracy in the spacing or "indexing" of the worm threads. Specially designed fixtures are employed for this purpose. There are a number of methods available for testing the lead of the worm thread, but a special fixture or machine built for this purpose is desirable. All these tests depend upon the accuracy of the testing device.

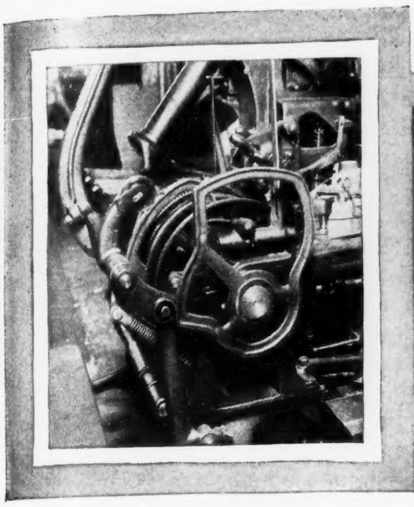
The only inspection test requiring skill and judgment on the part of the operator is the method of testing the profile of the worm thread. A fixture similar to that used for testing the lead of the worm thread is employed, and for profile testing, a plug having a conical point formed to fit accurately the profile of the thread space of the master worm on the normal section is used. When such a plug is used for testing worm thread profiles, a lamp or reflector is placed below the worm and a light beam passing between the plug and the thread profile affords a satisfactory basis for the test. A skilled operator is required for this work, however, as there is no quantitative measure for the light beam, and experience must dictate the difference between an allowable and an objectionable error. How much error may be permitted is determined by a running test where worms and gears are operated under actual working conditions.

The contour projection method of worm thread form checking that is now applied to screw threads may, in the future, be used for worm thread form comparison, but the size of the work handled and the large helix angles employed are severe handicaps to overcome in working out such a method on a commercial scale.

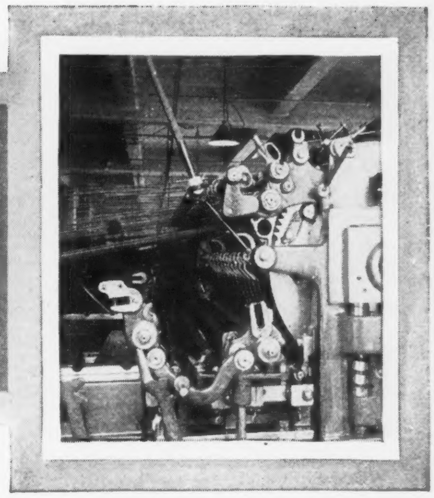
Mr. Acker also pointed out the importance of suitable lubricants for worm-gears. The best workmanship and the best materials are of no avail if the lubricant does not prevent metallic contact between the worm and the gear, or if it, through excessive fluid friction, produces too high an operating temperature. The functions of the lubricant are to reduce the sliding friction by preventing metallic contact and to carry away the heat from the gearing at a sufficient rate to prevent undue local heating.

In worm-gearing operating at high speeds, where the rolling action is rapid, the conditions are favorable to the formation of an oil film. Further, the dwell or length of time in which a given tooth contact exists is relatively brief, so that the time available for squeezing out the oil is slight; consequently, a relatively light-bodied oil can be used to carry safely all the load that the bronze gear will stand at high speed.

If, however, the same oil is used at very low speeds, where the dwell of the teeth in contact is greater, the load borne by the oil safely will be but a small percentage of that carried at high speeds. To realize the full load-carrying capacity of the bronze gear, therefore, a much heavier lubricant is required at low operating speeds, and such a lubricant can be safely used because of the low fluid velocities under these conditions.



Ingenious Mechanical Movements



MECHANICAL MOVEMENT OF A SAW-FILING MACHINE

By CHARLES E. WOODS

In the handsaw-filing department of the Simonds Saw & Steel Co., Fitchburg, Mass., the double handsaw-filing machines are equipped with an interesting mechanical movement for obtaining the motion required in filing the saw teeth. As one file is being drawn across the saw, the other file, which has been raised to clear the saw, is returning. When the file in the raised position reaches the end of the return stroke, it is lowered to the saw, and during the filing stroke, the first file mentioned is being returned in the raised position, the files operating alternately.

The mechanical motion for operating the two files is derived from the combination of a special internal gear driven by a pinion having a projecting shaft which engages a slotted cam guide that keeps the pinion and internal gear in the proper relative positions. The illustration shows a front view of the two filing heads and a section *x–y* through the left-hand head. The outside of one filing head is shown at the right of the illustration, and the inside mechanism is shown by the left-hand view of the opposite head.

Each slide is pivoted on a shaft *A*, and pinion *B* revolves in mesh with the internal gear *C*. The pinion is held in contact with the internal gear teeth by an extension of the pinion shaft beyond the face of the pinion gear. The end of this shaft revolves in the slotted guide *D* which controls the motion. The file-holding head *E* operates on the slide *F* during the filing and return strokes. On the filing stroke, the internal gear teeth are being driven from the bottom of the pinion gear, whereas on the return stroke the internal gear is being driven from the top of the pinion gear. The file-holding arm *G* is under the pressure of a coil spring in *K*. The file-holding arm pivots from *J*, there being slots at *H* to allow for the necessary swinging movement.

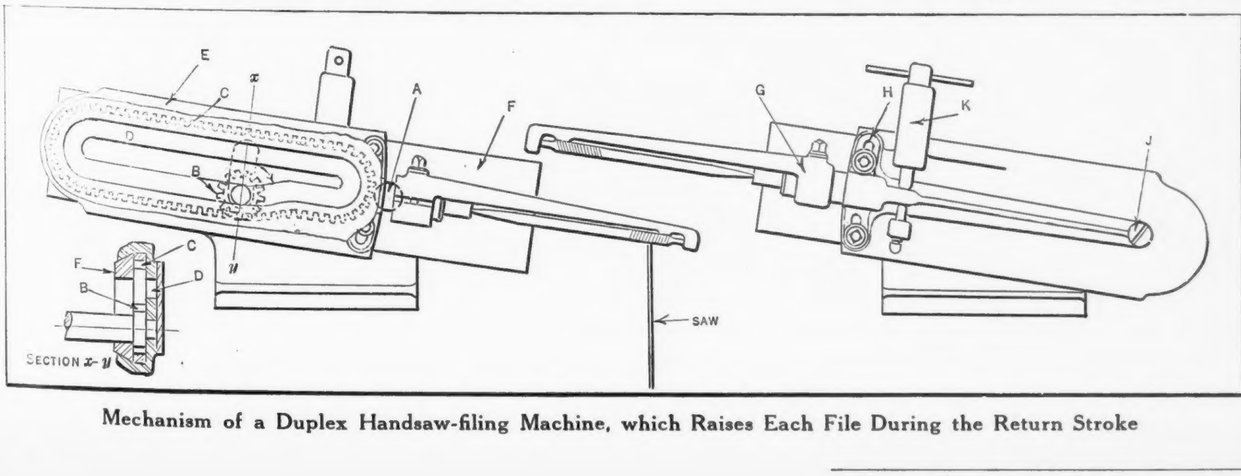
The left-hand view shows the file nearly at the end of its cut and about to leave contact with the saw and travel a short distance to clear the end of the file-holder; then as it is being raised to its highest point, the file of the right-hand head is lowered to start its cut. A plan view would show the files working at opposite angles, to file the proper bevel into the handsaw teeth. An interesting feature is a 5 to 1 gear ratio, but due to a loss of one-half revolution at each end of the stroke, the ratio is 4 to 1 for a complete filing cycle.

* * *

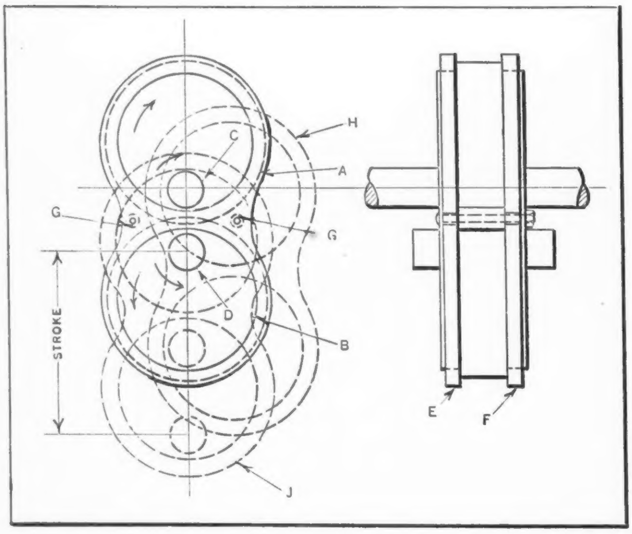
COMPACT LONG-STROKE MECHANISM

By W. R. WARD

The mechanism shown in the accompanying illustration was designed by the writer to give a long stroke within a small space. A harmonic reciprocating motion is obtained. The device consists of two gears *A* and *B* fitted on eccentrically positioned shafts *C* and *D*. Two concentric surfaces turned on each gear act as eccentrics with respect to the shafts. Two yokes *E* and *F* with two stays secured by bolts *G*, keep the two gears in mesh as shown, the gears being meshed in such a manner that the shafts are nearest each other at one end of the stroke. The drive shaft *C* is mounted in bearings on the machine frame, and the other shaft *D* is attached to the reciprocating part of the



Mechanism of a Duplex Handsaw-filing Machine, which Raises Each File During the Return Stroke



Long-stroke Mechanism so Designed that Length of Stroke Depends upon Relative Positions of Eccentric Gears

machine with its gear free to turn on the shaft or with the shaft.

If desired, the machine can be equipped with ball or roller bearings throughout, and it can be made fairly light by using hollow shafts and gears. The full lines show the mechanism in the position it occupies at the upper end of the stroke, the dotted lines at H show the mechanism in the position it occupies when the drive shaft has rotated through an angle of 90 degrees, while the dotted lines at J show the mechanism at the end of the down stroke, after the drive shaft has rotated through an angle of 180 degrees. If the driven gear is located 180 degrees from the position shown, rotation of the driving gear will not result in reciprocating motion; therefore, a stroke from zero to the maximum can be obtained by varying the relative positions of the driven and driving gears. Although the mechanism could be designed to permit stroke adjustments while in motion, this would make the design more complicated.

* * *

ROLLING MILL ROD-SWITCHING DEVICE

By A. G. RIPBERGER

In making steel wire, a billet of the proper size is heated and reduced in cross-section in a series of mill stands. The steel emerges from the last or finishing stand in the form of a small rod which is several thousand feet long and moves at a speed of 25 miles per hour or more. This rod is guided through pipes to a horizontal reel, the speed of which is automatically regulated according to the speed of the finishing stand, and this forms the rod into a coil. The coiled rod is removed from the reel by a suitable mechanism and then reduced to a wire by cold-drawing through a series of dies.

In order to obtain high efficiency, the rods follow one another very closely; in fact, there is only a space of a few feet between the rear end of one rod and the forward end of the next rod. Since it would be impossible to clear the reel in these short time intervals, it is necessary to employ two reels and coil the rods alternately on them. This requires a switching device which directs the rods to the two reels in alternation.

Before describing the switching device, it might be well to summarize the conditions: (1) The rods are white-hot; (2) they move at a high rate of speed; (3) the time available for the switching device to act is very short, and the action must be instantaneous; (4) the rods are of different lengths, so that switching must occur at irregular intervals; (5) the device must possess a maximum degree of reliability, because its failure would cause considerable danger and a decrease in production. The device to be described meets all of these conditions in a very simple manner.

In the diagram Fig. 1, M represents the finishing stand of the mill while R_1 and R_2 are the two reels. Pipes P, P_1, and P_2 are stationary, and S is a pipe that can swing around fulcrum F in such a manner that while one end always registers with P, the other end will register with either P_1 or P_2. This switching motion is controlled by a mechanism at D, which is shown in Fig. 2 to a larger scale. Bellcrank C can swing around stationary pin Q, moving pipe S into either of the two necessary positions. A three-way valve R is operated by the bellcrank. Parts B_1 and B_2 are buckets, each having a hole in the bottom. Water flows into each bucket alternately, in a volume exceeding that of the outflow at the bottom, so that the water level in the bucket gradually rises.

In the position shown in full lines, bucket B_2 is receiving water and becoming slowly heavier, while bucket B_1 is emptying itself and becoming lighter;

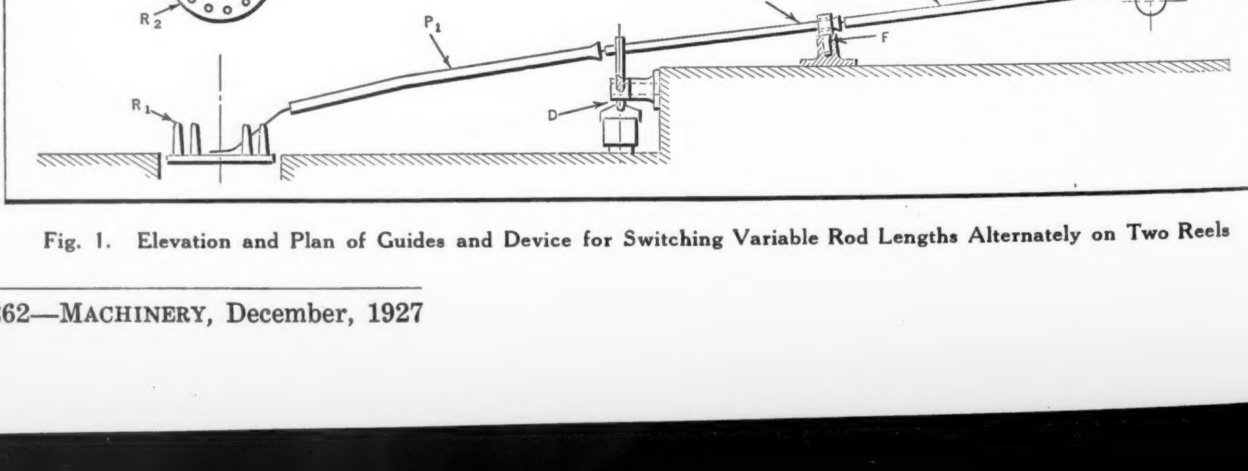


Fig. 1. Elevation and Plan of Guides and Device for Switching Variable Rod Lengths Alternately on Two Reels

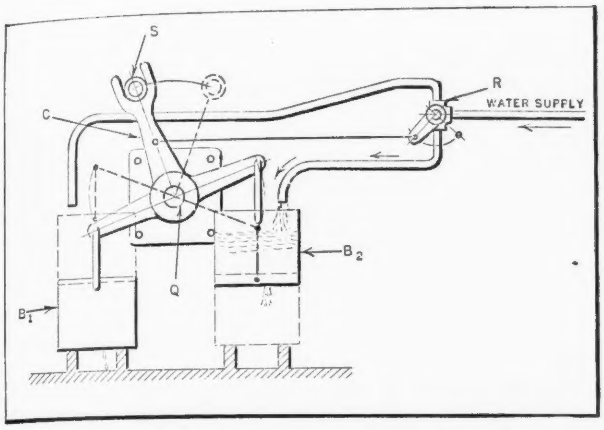


Fig. 2. Mechanism of Automatic Switching Device

hence the bellcrank tends to swing into the dotted position, thereby reversing the three-way valve, which diverts the stream of incoming water to bucket B_1 and allows bucket B_2 to become empty.

Now the only obstacle to such a motion of the bellcrank is furnished by the rod which, running from S to P_1 (Fig. 1), bridges the gap between the two pipes and acts, so to speak, as a splice. But at the instant that the tail end of the rod leaves pipe S, the motion of the bellcrank takes place. This action is, of course, reversed when the tail end of the next rod leaves pipe S. The amount of water is so regulated that the scraping action on the side of the rod is slight and therefore not injurious. This device, with provisions for manual control in case of emergency, is in actual use.

* * *

NOISELESS STOP RATCHET FOR ONE-WAY ROTATION

By R. H. KASPER

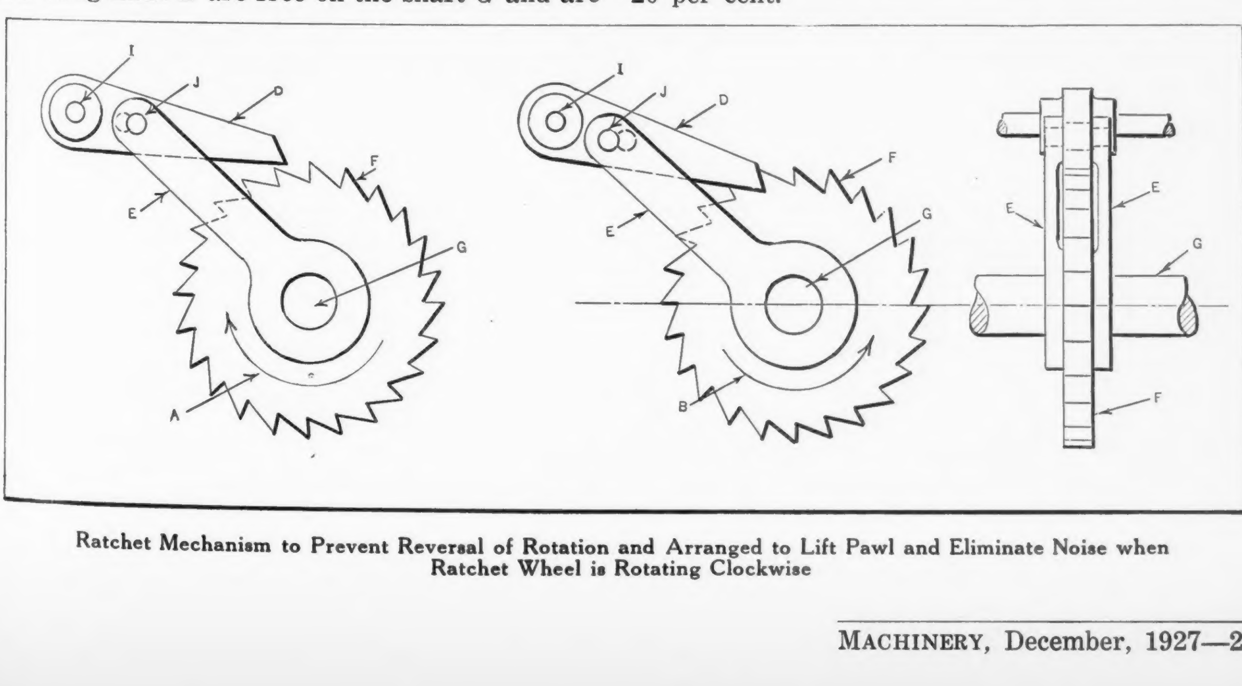
The accompanying illustration shows the construction of a ratchet mechanism that was designed for use on machines in which the noise of the pawl passing over the teeth of the ratchet was objectionable. Incidentally, the continuous wear on the ratchet teeth and the end of the pawl is eliminated by the arrangement shown.

The ratchet wheel F revolves with the shaft G. The pawl D swings freely on the pivot I, which is held in the stationary part of the machine. The connecting links E are free on the shaft G and are held together at their upper ends by the rivet J which has a shoulder on both sides. This permits the links to be tightly fastened together and still be free to swing on the pawl D. The links E are sprung together, or toward each other at the lower end, so that they have a slight friction bearing on the sides of the ratchet wheel F. There is an elongated hole in pawl D through which rivet J passes.

The action of the mechanism is very simple but effective. When shaft G is turned in the direction of the arrow shown at A, ratchet wheel F turns with the shaft. The friction on the sides of ratchet wheel F has a tendency to revolve links E with the wheel. The tendency to revolve, however, is prevented by rivet J which passes through pawl D. This action results in lifting pawl D out of contact with wheel F and holding it out of contact as long as shaft G is turned in the direction indicated by arrow A. The height that pawl D is lifted above the ratchet wheel is controlled by the length of the slot through which rivet J passes. As soon as shaft G revolves in the opposite direction, as indicated by arrow B, links E tend to revolve with the ratchet, and this results in bringing pawl D downward into contact with the teeth of the ratchet wheel, as shown in the view at the right.

* * *

The Association of German Machine-Building Plants recently published a report dealing with the world's production and trade in machinery. According to this report, the world's production of machinery in 1913 was valued at approximately \$3,300,000,000, and in 1925 at \$5,400,000,000. In 1913 the productive capacity of the machine-building industries in general were fully utilized, whereas in 1925 only 75 per cent were utilized. In 1913, 50 per cent of the total output was credited to the United States; 20 per cent, to Germany; and 12 per cent, to Great Britain. In 1925, the proportions were, the United States, 57 per cent; Germany, 13 per cent; and Great Britain, 13.5 per cent. Of the machinery exported for the world's markets in 1913, the United States supplied 27 per cent; Great Britain, 28 per cent; and Germany, 29 per cent. In 1925, the United States exported 35 per cent; Great Britain, 24 per cent; and Germany, 20 per cent.



Ratchet Mechanism to Prevent Reversal of Rotation and Arranged to Lift Pawl and Eliminate Noise when Ratchet Wheel is Rotating Clockwise

Notes and Comment on Engineering Topics

The automobile industry is an important buyer of many materials other than metals. Nearly two-thirds of all the upholstery leather used in the United States is employed in automobiles.

A course in the prevention of accidents has become a permanent part of the curriculum of New York University beginning with the present college year. The American Museum of Safety, 141 E. 29th St., New York City, is cooperating with the university in presenting the course. The course is open to all men and women who have any connection with or direct interest in accident prevention. There are no academic entrance requirements.

With a production of approximately 400 cars a day, the Citroen Works at Paris are probably the largest producers of automobiles outside of the United States. The Citroen automobile is a small, light, low-powered car, built at a medium price. The present annual production of the entire French automobile industry is about 200,000 cars. A great many of these are exported. The total number of cars in use in France is between 600,000 and 700,000.

The great amount of engineering and technical work done by the American Society of Mechanical Engineers becomes apparent to one who looks over the recently published technical committee list, which covers approximately 250 technical committees of the society, to the work of which 567 members give their time and experience without compensation, in addition to 497 non-members who are also cooperating with the society in its engineering and technical work for the benefit of the mechanical industries as a whole.

Roller bearings are being used on passenger railway cars to an ever-increasing extent. The Hyatt Roller Bearing Co. announces that more than fifty of the country's principal steam and electric railways are now installing roller bearings on rolling stock. One railway car so equipped has traveled more than 325,000 miles without replacements or marked wear. An important feature of the railway roller bearings made by one of the leading roller bearing manufacturers is that they are interchangeable with standard railway journal boxes without changing the present truck construction.

According to a world's census of motor vehicles, just compiled by the Automotive Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., there were on the first of January, 25,268,500 cars, trucks, and buses of American manufacture in use throughout the world. This represents over 95 per cent of all the automobiles in the world. The United States, with but 6 per cent of the world's population, has 80 per cent of the world's automobiles.

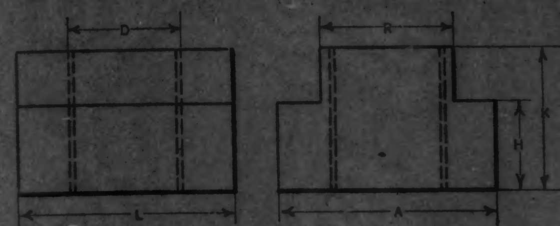
The Department of Commerce and Industry of the Osaka Municipal Office, Osaka, Japan, is planning to hold an exhibition of advertising novelties, and is inviting American firms to send advertising novelties to the department for exhibition purposes. If those who send samples wish them returned after the exhibition, the department offers to do so at its own expense. It is understood that all novelties for exhibition should actually be provided with advertising of some kind on them. Osaka is the largest distributing and manufacturing center of Japan, and has a population of 2,200,000; hence the city is well suited for the purposes of the contemplated exhibition.

A recent issue of *Engineering* gives some interesting statistics relating to the building of steam engines and steam turbines for marine purposes in different parts of the world. These statistics also include the production of marine oil engines. While the statistics do not include the steam turbines building in Germany, it nevertheless appears that the horsepower of marine oil engines now being built is greater than that of both turbines and reciprocating steam engines combined. Reciprocating steam engines account for 29 per cent of the total horsepower being built, steam turbines for 17 per cent, and oil engines for 54 per cent. The total horsepower of oil engines under construction or being installed for the propulsion of ocean-going vessels amounts to over 1,100,000 horsepower. The rapid strides of the oil engine in the last ten years are of unusual interest.

Revived discussion of a trans-Isthmian canal at Nicaragua is a reminder of the stupendous industrial development and transportation demands of the country in recent years. When the Panama Canal was opened, few people believed that, short of many decades, it would pay its way. Inside of twelve years, it is paying for operation, interest on the investment, and a big annual profit to the Government. Now business is in sight exceeding the canal's capacity. Whether a new canal shall be built in Nicaragua or the Panama Canal shall be rebuilt to increase its capacity is the question; but it has suddenly become seriously doubtful whether either plan can be executed soon enough to avoid congestion. By far the largest factor in the canal's business is one which nobody anticipated when the canal was started, namely, the transport of petroleum. While this particular business has grown so fast that it threatens to exceed the canal's capacity, it has not only taken no freight away from the railroads, but has actually added enormously to their freight business.

MACHINERY'S DATA SHEETS 119 and 120

AMERICAN STANDARD T-NUTS



Approved by American Engineering Standards Committee, National Machine Tool Builders' Association, and American Society of Mechanical Engineers.

Tap for Stud D*		Width of Throat T-slot	Width of Tongue R			Width of Nut A†			Height of Nut H†			Total Thickness, Including Tongue K	Length of Nut L‡
Diameter	Threads per Inch		Maximum (Basic)	Tolerance (Minus)	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum		
1/4	20	11/32	0.330	0.010	0.320	9/16	0.031	17/32	3/16	0.016	11/64	9/32	9/16
5/16	18	7/16	0.418	0.010	0.408	11/16	0.031	21/32	1/4	0.016	15/64	3/8	11/16
3/8	16	9/16	0.543	0.010	0.533	7/8	0.031	27/32	5/16	0.016	19/64	17/32	7/8
1/2	13	11/16	0.668	0.010	0.658	1 1/8	0.031	1 3/32	13/32	0.016	25/64	5/8	1 1/8
5/8	11	13/16	0.783	0.010	0.773	1 5/16	0.031	1 9/32	17/32	0.031	1/2	25/32	1 5/16
3/4	10	1 1/16	1.033	0.015	1.018	1 11/16	0.031	1 21/32	11/16	0.031	21/32	1	1 11/16
1	8	1 5/16	1.273	0.015	1.258	2 1/16	0.031	2 1/32	15/16	0.031	29/32	1 5/16	2 1/16
1 1/4	7	1 9/16	1.523	0.015	1.508	2 1/2	0.031	2 15/32	1 3/16	0.031	1 5/32	1 5/8	2 1/2

All dimensions in inches.

*When T-nuts are used, stud *D* is made smaller than the corresponding T-bolt, to insure the full strength of T-nut.

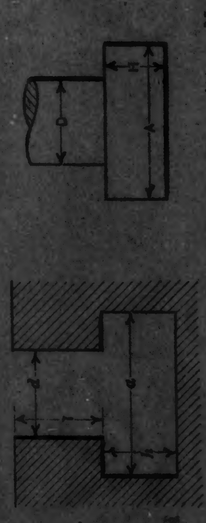
T-nuts are sometimes useful where the ends of the T-slot are obstructed so that the bolt cannot be slipped in and out.

†T-slot dimensions to fit T-nuts of the sizes listed will be found in Data Sheet No. 120.

‡There are no tolerances given for the "total thickness" or "length of nut," as these dimensions do not need to be held to close limits.

MACHINERY'S Data Sheet No. 119, New Series, December, 1927

AMERICAN STANDARD T-SLOTS AND T-BOLTS



Approved by American Engineering Standards Committee, National Machine Tool Builders' Association, and American Society of Mechanical Engineers.

Diameter of T-bolt*	Width of Throat d* †	Depth of Throat T		Head Space Dimensions and Tolerances: Width a			Depth h		
		Maximum	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum	Maximum (Basic)	Tolerance (Minus)	Minimum
1/4	9/32	3/8	1/8	9/16	0.063	1/2	15/64	0.031	13/64
5/16	11/32	7/16	5/32	21/32	0.063	19/32	17/64	0.031	15/64
3/8	7/16	9/16	7/32	25/32	0.063	23/32	21/64	0.031	19/64
1/2	9/16	11/16	5/16	31/32	0.063	29/32	25/64	0.031	23/64
5/8	11/16	7/8	7/16	1 1/4	0.063	1 3/16	31/64	0.031	29/64
3/4	13/16	1 1/16	9/16	1 15/32	0.094	1 3/8	5/8	0.031	19/32
1	1 1/16	1 1/4	3/4	1 27/32	0.094	1 3/4	53/64	0.047	25/32
1 1/4	1 5/16	1 9/16	1	2 7/32	0.094	2 1/8	1 3/32	0.063	1 1/32
1 1/2	1 9/16	1 15/16	1 1/4	2 21/32	0.094	2 9/16	1 11/32	0.063	1 9/32

All dimensions in inches.

*In addition to the width of throat given, a secondary standard is recognized, having the width of throat the same as the nominal diameter of the T-bolt. This is to provide for the use during the transition period of this standard on machine tools where it is already established.

†A tolerance of minus 0.001 is allowed for width of throat when tongues or other parts must fit.

Diameter of T-bolt D	Threads per Inch	Bolt Head Dimensions and Tolerances: Width across Flats A			Width across Corners	Height H		
		Maximum (Basic)	Tolerance (Minus)	Minimum		Maximum (Basic)	Tolerance (Minus)	Minimum
1/4	20	15/32	0.031	7/16	0.663	5/32	0.016	9/64
5/16	18	9/16	0.031	17/32	0.796	3/16	0.016	11/64
3/8	16	11/16	0.031	21/32	0.972	1/4	0.016	15/64
1/2	13	7/8	0.031	27/32	1.238	5/16	0.016	19/64
5/8	11	1 1/8	0.031	1 3/32	1.591	13/32	0.016	25/64
3/4	10	1 5/16	0.031	1 9/32	1.856	17/32	0.031	1/2
1	8	1 11/16	0.031	1 21/32	2.387	11/16	0.031	21/32
1 1/4	7	2 1/16	0.031	2 1/32	2.917	15/16	0.031	29/32
1 1/2	6	2 1/2	0.031	2 15/32	3.536	1 3/16	0.031	1 5/32

MACHINERY'S Data Sheet No. 120, New Series, December, 1927

The British Metal-working Industries

From MACHINERY's Special Correspondent

London, November 17, 1927.

FOR the first time in many months it is possible to write in an optimistic vein concerning conditions in the British metal-working industries. Not since the spring of 1926 have indications of a general trade revival been so much in evidence. The brightness of the prospects at present is marred only by the comparatively unhealthy state of the basic industry of steel production. The reasons for the conditions prevailing in this industry are not far to seek; their remedy is altogether a different problem. This country, in common with other European countries, suffers from over-production of steel—or rather from a capacity for over-production. Unfortunately, this state of affairs is more acute in Great Britain than on the Continent, due principally to the enormous expansion in the British steel industry during and immediately after the war. Overhead costs are consequently higher, which is one of the factors that enable Continental manufacturers to undercut British manufacturers' prices substantially.

The Automobile Shows in Great Britain

It is but natural that interest has centered on the automobile industry of late. The Motor Show held at Olympia, October 13 to 22, was followed after a week's interval by the Motor Cycle and Cycle Show, while November 15 marked the opening of the Road Transport Vehicle Show. In addition, the Scottish Motor Show was held at the Kelvin Hall, Glasgow.

The most noteworthy feature of the Motor Show was the number of six-cylinder cars exhibited by British manufacturers. Thus of 140 types of British cars on the market for 1928, 50 have six-cylinder engines as against 79 with four-cylinder engines. There also appears to be a tendency to restore coil ignition, once almost extinct among cars of British manufacture, 15 British cars being now fitted with this form of ignition. Among British car engines, overhead valves now show a marked preponderance, no fewer than 75 being so equipped, while side-by-side valves account for 48, and sleeve valves for 13. The 1927 show marked a great increase in the popularity of the closed cars, and more particularly closed cars with pressed-steel and fabric panelled bodies. There was a record attendance at the show.

British Automobile Registration and Production

The figures for mechanically propelled vehicles licensed in this country during 1926 showed an increase of 11.8 per cent, as compared with 1925, the actual numbers being 1,729,000 as against 1,547,000. It is estimated that in 1926 there was one motor vehicle to every twenty-six people.

Interesting figures are now available indicative of the growth of the automobile industry in Great Britain. In 1924, the numbers of cars and commercial vehicles produced were 105,468 and 26,532, respectively; in the following year, 121,000 and 32,000; and last year, 138,000 and 41,500. There is no doubt that when the figures for 1927 are available they will again show an increase, and it may be confidently anticipated that 1928 will eclipse 1927.

The Machine Tool Industry Looks Forward to Better Business

It is but natural that increased business in the machine tool industry should result from the healthy condition of the automobile industry and of shipbuilding. The most pessimistic reports are still those that come from the Clyde district, but even there the general view is that the long deferred and much needed re-equipment of the shipyards must result in substantial orders at no far distant date. Among English machine tool manufacturers, and particularly in the Leicester, New Castle, and Birmingham districts, a note of optimism prevails, and several important firms report better conditions than at any previous period in their history.

The most vexing question in the machine tool industry today concerns the wisdom or otherwise of the decision of the Machine Tool Trades Association in continuing the ban on German machine tools for the 1928 Exhibition at Olympia. Criticism of this action has been freely expressed on the grounds of its inconsistency and of the fact that under such conditions the exhibition fails to be representative, and therefore loses much of its value. At least one important member of the association has seceded solely on these grounds.

Overseas Trade in Machine Tools Falls Off

So far as the overseas trade in machine tools is concerned, September was a bad month. The exported tonnage fell sharply from 1387 tons in August to 830 tons in September, with a corresponding fall in value from £148,030 to £87,998, the ton value remaining practically constant. Imported tonnage, on the other hand, rose to the highest point since the war, with 985 tons valued at £91,354. The value of tools and cutters exported rose slightly from £53,414 for August to £55,779. Imports are establishing a very high level, over double that of the period 1921-1924.

London-Paris Air Lines Now Carry First and Second Class Passengers

The institution of second-class travel facilities on air liner services between London and Paris marks a definite stage in the development of civil aviation in this country. At the same time it has been found possible to reduce the first-class fares. The first-class single fare is now £4 15s. and return £9. The single second class fare is £3 15s. and return £7 10s.

Current Editorial Comment

in the Machine-building and Kindred Industries

REDUCING LOCOMOTIVE REPAIR COSTS

Superintendents, master mechanics, and foremen in charge of locomotive repair and other railway shops realize the value of good equipment, but obtaining modern tools usually is a hard nut to crack. The higher officials do not authorize expenditures for tool equipment until they have been convinced that the net savings will justify the investment; and it is particularly difficult to furnish accurate figures representing all of the savings made possible by using first-class tools, because the prevention of repairs and the reduction in non-productive repair periods made possible by using such tools, must be taken into account, as well as the direct savings in the shop due to increased output.

If the non-productive period of a locomotive undergoing repairs is prolonged unduly, repair costs will be greatly increased, because the locomotive is temporarily a dead investment. Then, too, delay in repair work, often traceable to lack of proper equipment, tends to result in a large number of repairs by permitting slight defects to become serious ones. The direct relationship between such losses and obsolete tool equipment is not always considered, but it exists nevertheless. Modern tools not only reduce the repairing time, but frequently produce more accurate and, consequently, more durable work. Such tools include, in addition to the highly efficient machine tools now obtainable, hand tools and work-handling devices that assist greatly in keeping locomotives out of the hospital and on productive work.

The shop executive who has old tools that are in fair condition will find it particularly difficult to give to the man higher up satisfactory reasons for their replacement. But the fact remains that the plan of using obsolete machines or other tools merely because they are "almost as good as new," is often the cause of preventable waste. A machine may be "just as good as new," and still be old as a producer; for any type of machine or tool is obsolete when it can no longer compete with improved designs. Poorly equipped shops tend to pull the rolling stock down to their level, and are certain to cause heavy expenditures which may never be properly accounted for, owing to lack of direct evidence.

COSTLY HAND-TO-MOUTH BUYING

The practice of buying in small quantities for immediate needs increases the cost of filling orders in every industry, but in none has it been carried to such extremes as in the purchase of small tools and machine shop accessories. One manufacturer of small tools received three orders from the same customer in two days, each being for two or three small taps and dies, amounting to approximately one dollar. The average office and shipping room cost of filling such an order, including shipping room orders in the office, packing, addressing, recording, billing and collecting—but not including overhead—amounts to more than a dollar, so that the goods were given away. Buying in extremely small quantities is practiced both by manufacturers and dealers. Small orders are placed for standard tools which both manufacturers and dealers should keep constantly in stock to meet their needs. The manufacturers of small tools, to protect themselves, must either increase their prices on such orders, or better still—make a service charge for those orders below a certain minimum amount that require separate handling.

STANDARDIZED PLANER TOOLS

The cutting angles and the shape of planer tools determine to a great extent the production obtained from a planer. The right roughing tool for planing steel, for example, has too keen an edge for planing cast iron, and would have a tendency to dig into the metal and cause chatter. Usually when the planer hand finds that his tool chatters, he remedies the difficulty by reducing the feed, thereby decreasing production. The better way would be to change to the right kind of tool so that the highest possible feed could be maintained.

One planer company, recognizing the need for correct knowledge of the tool angles and shapes best adapted to different kinds of planer work, has developed a chart that shows a suitable set of tools for different purposes, indicating the use for which each tool is intended. The intelligent use of such a chart makes it possible to obtain maximum production from a planer. To supplement the chart, the same company has also produced aluminum models, numbered to correspond with the chart and having the various surfaces accurately ground. With the help of these models, the toolsmith who forces the tool can more readily produce a tool like the model than forge it to a drawing. These models also are helpful in grinding the tools to the correct shape and angles.

* * *

BALANCING HIGH-SPEED PULLEYS

In ordinary machine construction, the necessity for careful balancing of pulleys or other machine parts that are to rotate at high speeds is not so thoroughly appreciated as it should be. In automobile construction, the need for balancing flywheels and crankshafts to prevent excessive vibration has long been recognized, and excellent balancing machines are now available for the purpose. Machine pulleys should be balanced with equal care if vibrations in machines operated at high speed are to be avoided. An engineer of wide experience recently pointed out that high-speed pulleys are frequently the cause of excessive vibration in machine tools, but it is seldom that the unbalanced condition of the pulleys is suspected to be the cause, and other remedies are often tried.

Relations with Our Employes

By E. M. HERR, President, Westinghouse Electric & Mfg. Co.

INDUSTRIAL relations, employe representation, human relations, personnel activities, welfare provisions—these are all familiar expressions to most people in touch with industry today, and they indicate an increasing interest, on the part of those in responsible charge of our rapidly expanding industries, in the man-power essential to the success of these industries.

No argument is needed to establish the fact that there has been rapid growth in recent years along all lines of human endeavor, and that with this growth has come an increasing complexity in organization and management, which has added to the burden of responsibility of those entrusted with the formulation and execution of policies vitally affecting the lives of great numbers of human beings. We, in America, are in the midst of what might justly be termed a revolution in methods and processes. Machinery is daily lifting the burden of toil from the backs of men and women. It is daily adding to the output of our factories and making possible mass production in the manufacture of the majority of our necessities. Transportation facilities have been improved, permitting a more economical distribution of the products of field, forest, and factory. None dare prophesy what still remains to be accomplished in the further development of this marvelous machine age for the benefit of mankind.

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E. M. Herr, President Westinghouse Electric & Mfg. Co.

The Importance of the Human Factor in Industry

It is recognized that there are at least two major divisions in industrial work—the machinistic and the humanistic. The machine, the product of the brain and skill of the human being, cannot be endowed with a human brain; and we are, more and more, coming to the place where we are not content to place the human on the level of the machine, thereby robbing him of his divine right to think. Industrial relations have developed along lines that have brought about increasingly satisfactory contact between employer and employe. The Westinghouse Electric & Mfg. Co. may be classed among the pioneers in the development of channels through which these relations have been fostered and maintained. For many years there was the inspiration of a great personality—Mr. George Westinghouse, its founder—who won the respect and support of his associates by his democratic and helpful attitude. Although Mr. Westinghouse has been dead thirteen years, the spirit of loyalty has continued to grow, as the management has, from the very beginning, recognized the importance of the human element in industry.

How Sickness and Old Age are Provided for

Realizing, as it has, the difficulty of keeping close contacts with its employes as the plants grew in number and size and were located in widely scattered districts, it early established the policy of encouraging the employes to share, where practicable, in the activities of the company. The company maintains one of the most liberal and successful relief associations in existence. Members of this association are paid weekly benefits in case of disability until they reach the age of 70, when they are transferred to the pension roll. In connection with this relief association, a medical department, with an adequate force of physicians and nurses and modern equipment, is maintained. All first-aid cases are given treatment by thoroughly competent physicians or nurses, and the medical staff is available for consultation and for periodic examination when the employes wish to avail themselves of these privileges. A tuberculosis dispensary is maintained in the East Pittsburg plant, which cooperates with the Pennsylvania State Department of Public Health. This dispensary service is extended to members of the families of employes with very good results. The company has also donated a cottage to the state sanitarium for the treatment of tuberculosis, where employes who need such treatment are at liberty to stay. The company pays all administrative expenses of the relief association, including equipment, supplies, office space, and personnel; dues paid by the members, which are very small, are used only for the payment of sick benefits to those on the disability roll.

Encouraging Thrift is a Duty of Progressive Management

Management today is giving close attention to constructive programs that will build up the morale of the employes along the lines of thrift and savings, life insurance, and ownership of homes. Under the Group Life Insurance Plan a $500 insurance policy is given to each employe on the completion of six months' service. No physical examination is required for this insurance. If at the end of this six months' period the employe elects to save a minimum of 2 per cent of his wage or salary by making regular deposits in the Employes' Savings Fund, on which interest at 4 1/2 per cent is compounded semi-annually, an additional $500 insurance policy is given him, making a total of $1000. At the end of the sixth year of service and saving, and continuing to the end of the fifteenth year, the company adds $100 per year to the life insurance, so that when an employe has served fifteen years he will have a maximum insurance of $2000.

In making regular saving a requirement for the maximum insurance, it is the hope of the management that the good effects resulting from this fifteen-year period of saving will establish a habit of thrift that will continue after the incentive of added insurance is removed. At the expiration of this fifteen-year period, the employe may draw all his savings with accrued interest and still be covered by the $2000 insurance as long as he remains with the company; if he so desires, he may also continue making regular deposits in the Savings Fund.

How the Home Buyer is Encouraged

In cases of emergency, an employe may borrow up to 90 per cent of his deposits, but must pay it back at the rate of 10 per cent per month with 6 per cent interest added. If an employe is buying a home and needs his savings for a payment, or for the reduction of a mortgage on a home already purchased, he may draw his total savings and not jeopardize his insurance coverage, provided he continues to save a minimum of 2 per cent of his wage.

In addition to this group insurance plan, the company has a contributory life insurance plan, under which an employe can procure additional insurance at a low cost, the amount of such contributory insurance which can be taken out being based on the earnings of the employe. Approximately 75 per cent of the employes eligible are participating in this form of insurance.

The Westinghouse Pension Plan

The pension plan of the company is based on earnings and length of service. Pensions are granted an employe when he reaches the age of 70, although he is not compelled to retire on a pension if he is able to continue at work and wishes to do so. The pension is figured at the rate of 1 per cent of the average monthly wage or salary during the last ten years of service multiplied by the number of years service, with a minimum pension of $20 per month for a twenty-year employe, and a maximum of $100 per month. The insurance at the time of retirement on pension remains in force without additional premiums as long as the pensioner lives, and on his death it is paid to his heirs. All of these contacts have promoted a better understanding between the company and its employes, and have had very beneficial results in many ways, in attracting a better class of labor, promoting thrift, and reducing labor turnover.

How the Employe Representation Plan Works

In 1919, a form of employe representation was introduced in the East Pittsburg Works that has functioned very satisfactorily since. This plan provides for the annual election of wage earners by popular vote. These elected representatives, with a like number of appointed representatives, form what is known as the works joint conference committee. Departmental committees, consisting of an equal number of elected and appointed members, are designated to confer on matters pertaining to a particular department. This plan works admirably in the adjustment of local questions and creates a cooperative spirit through these intimate contacts. There are four standing committees—the executive committee, shop regulations committee, community service committee, and cooperative buying committee.

The executive committee consists of one wage earner from each of the eleven districts elected by popular vote from the elected representatives of the works joint conference committee, together with an equal or lesser number appointed by the management. The executive committee confers at least once a month on all matters referred to it by departmental or other committees, and on such other matters of general interest as may rightfully be brought before it. The entire works joint conference committee meets at least every two months to hear the reports of the executive committee and to discuss such matters as may rightfully be brought before it, usually matters having a direct bearing on the employes. The general chairman, who is appointed by the management, presides at these meetings. All committee meetings are held on company time.

The shop regulations committee consists of six members, and makes periodic visits to various departments, reporting in writing to the executive committee upon conditions in general, such as need for repairs, disorderly condition of certain sections, excess material on floors or in stock, better care of plant and equipment, need for better heating or ventilation, etc. Some very valuable suggestions are made by this committee.

The community service committee handles matters outside the plant, such as transportation, street conditions, and like matters. The cooperative buying committee directs the selection and purchase of all merchandise sold to employes through the Employes' Store. This store sells practically everything a well organized department store in the same community would handle. It is well managed, has paid its own way from the start, and has a comfortable surplus against possible future losses.

Members of the works joint conference committee join with representatives of the management in a semi-annual review of all hourly wage rates to see that rates are paid in accordance with the job classification. As the management is repre-

sented on all standing committees, it has excellent contact with the employes.

Other Activities that Cement Friendly Relations between Management and Men

The company operates a cafeteria in a separate building where a first-class hot meal is served at noon at a reasonable price. It also operates a cafeteria for women office employes in a central location in the main building of the plant. In addition, the Westinghouse Lunch Club is maintained by a selected number of officers and heads of departments, and affords an excellent opportunity for social intercourse, as well as a convenient place to entertain the out-of-town guest.

The company has built for sale to employes at reasonable prices, and on the installment plan of buying, a number of desirable houses in the vicinity of some of its plants. These houses have found a ready sale and have aided in developing a fine community spirit among the owners. The company also maintains a limited number of houses for renting to employes.

In the Westinghouse Club, toward the upkeep of which the company is a liberal contributor, are found facilities for recreation of mind and body. Here are found a well equipped gymnasium with a competent physical director, game rooms, library, lecture rooms, etc. The club affords an opportunity to take advanced courses along many lines. Popular and scientific lecture courses are given. A nominal membership fee is charged, and an additional fee for those who use the gymnasium or attend the lectures. Any employe is eligible for membership in the club, which is very popular with college students in the company's employ. The club now has more than 1600 members.

Providing Needed Educational Facilities

The educational department of the company offers courses for the training of both men and women; a four-year course for apprentices who desire to become machinists; patternmakers, or toolmakers; a two-year course for high school graduates who desire to become draftsmen, accountants, cost clerks, salesmen, etc.; a one-year course for college graduates who desire training in engineering, works management, or salesmanship. The company partially supports the Westinghouse Technical Night School, which offers various courses for the betterment of the employes.

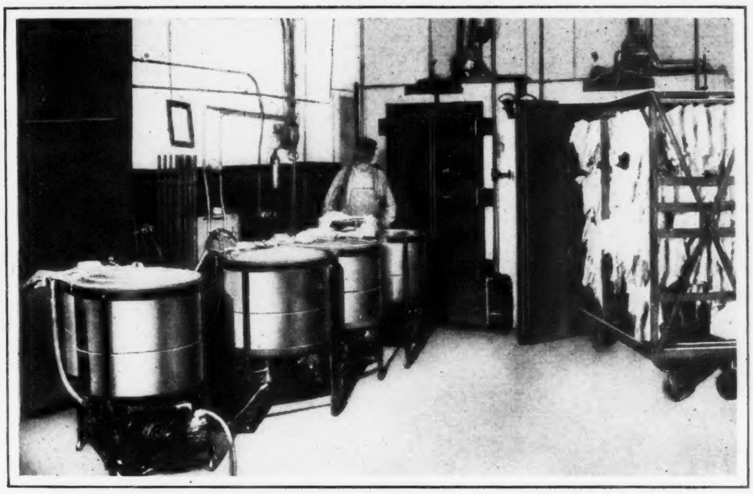
In the foregoing I have briefly reviewed the more outstanding activities of the company which lead to a better understanding between employer and employe. It is a subject in which the management is keenly interested and to which a great deal of time and thought is directed.

MACHINE SHOP SAVES $6000 A YEAR BY SALVAGING SOILED "WIPERS"

Prior to the installation of the present system of washing soiled wiping cloths, towels, etc., in the plant of the Syracuse Washing Machine Corporation, Syracuse, N. Y., all wiping cloths were discarded as they became soiled. An average of eight bales of cloths weighing about 700 pounds each, were used per month at a cost of 14 to 15 cents per pound, which represented a yearly expenditure of approximately $9700.

Since the installation of the washing system, this cloth consumption has dropped to 2 1/2 bales per month, representing a yearly cost of about $3000. Check-ups have proved that many cheap cloths have been rewashed and reused sixteen times. Better grade cloths have been used as many as forty times and are still in service.

Wash-room towels, hospital uniforms, etc., were previously sent to a commercial laundry at a yearly cost of $900. These pieces are also laundered in the shop now. Adding the saving of $900 to the saving of $6700, gives $7600. The total washing cost, including depreciation on the washing machines, wages of the workmen, gas consumption, etc., is $1155. The net saving, therefore, is $6445.



Equipment Used for Reclaiming Soiled Wiping Cloths

Clean wiping cloths are issued every morning from the tool-room to the foremen of the shop departments. Each of the four washing machines for this work handles an average daily wash of sixty pounds of dry cloths. Most cloths must be washed twice. A centrifugal drying tub extracts the water from the cloths after washing, and rinsing is also performed in the dryer.

* * *

The application of electric furnaces to purposes for which they were not originally intended was demonstrated, we are told, at a large Pennsylvania plant where an employes' Thankgiving dinner was staged and where the electric furnace used for heat-treating the product made in the plant was employed for cooking the Thanksgiving turkeys. The furnace is a direct-heat car-type annealing furnace rated at 205 kilowatts. The control was merely set down to 450 degrees F., the furnace preheated, and the turkeys placed in it. We are informed by one of those present that "they came out beautifully cooked, as I can attest having been one of the fortunate diners."

* * *

American manufacturers have increased their share of the machinery imports into India from barely 3 per cent of the total before the war to over 10 per cent for the year ended March, 1927.

Mammoth Double Crank Press

A DOUBLE crank press that is of unusual interest on account of its great size has recently been built by the E. W. Bliss Co., Brooklyn, N. Y. It is the largest double crank press that has been built by this company, the complete machine weighing over 600,000 pounds. The crankshaft is 16 inches in diameter at the bearings and 19 inches in diameter at the pins. The small press on the bed emphasize the mammoth size of the new machine. This development illustrates the increasing tendency toward building larger and heavier presses for manufacturing heavy metal stampings to replace articles previously made of castings.

The press is of the tie-rod construction in which the entire working strain is taken by four steel rods that tie the bed, crown, and uprights together. The uprights carry the weight of the shaft, gearing, crown, and slide. The bed is the largest casting ever made in the Bliss foundry, weighing 69 tons. It is of cambered construction. The arch section of the bed comes below the floor line, and is hidden in Fig. 1, as is also the spring-pressure drawing attachment which fits into the lower portion of the bed. To give an idea of its size, the bed is shown in Fig. 4, being machined on a planer having a distance of 14 feet between the housings.

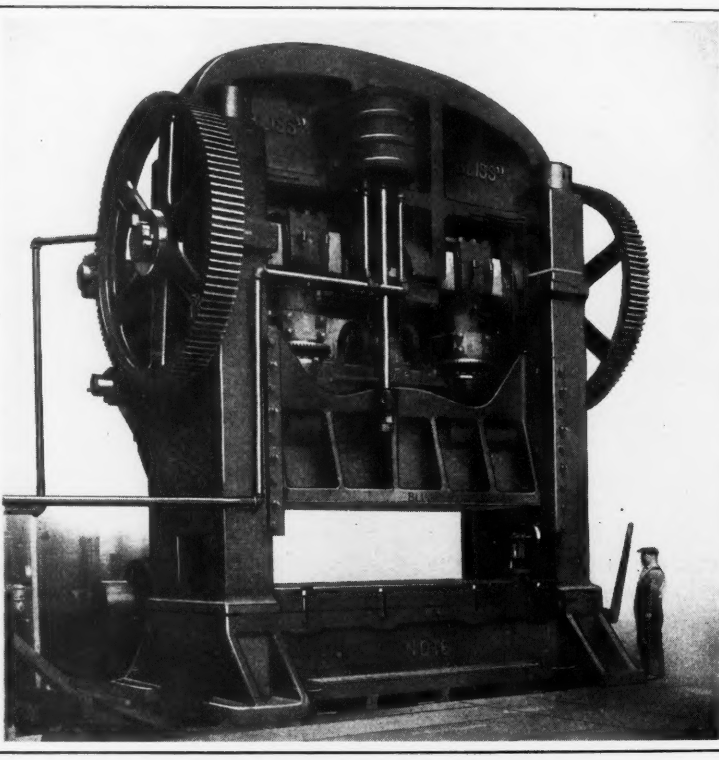


Fig. 1. Double Crank Press Built by the E. W. Bliss Co., which Weighs over 600,000 Pounds

The spring-pressure attachment has a capacity of 350 tons. It is shown in Fig. 3 assembled on the floor prior to being put into the bed. The crown of the press, which weighs 58 tons, is illustrated in Fig. 2 being drilled on a radial drilling machine.

The slide weighs 34 tons and is counterbalanced by two air cylinders attached to the crown, one cylinder being located on the front side of the machine as seen in Fig. 1, and the other on the rear side. Adjustments of the slide are made by means of a 15-horsepower motor. The press itself is driven by a motor of 150 horsepower capacity. It is twin driven through gearing having a ratio of 50 to 1. Some of the general dimensions of this press are as follows: Stroke of slide, 15 inches; distance between uprights, 160 inches; dimensions of slide face, 60 by 148 inches; dimensions of bed top, 60 by 160 inches; dimensions of opening in bed, 48 by 148 inches; and dimensions of bolster top, 60 by 158 inches.

* * *

TRADE DIRECTORIES—GOOD AND BAD

In a statement issued by the National Better Business Bureau, Inc., 383 Madison Ave., New York City, the fact that classified trade directories have become an essential part of the operating routine of industry is emphasized. Manufacturers and dealers are continually making satisfactory use of them and find them indispensable.

"But," says the National Better Business Bureau, "trading on the good will built up by legitimate directory publishers, there are today a great many unscrupulous persons who solicit advertising space or listings in fraudulent or questionable publications. The National Better Business Bureau has just completed a report on the work which has been accomplished to protect business men in all industrial lines from the operations of these fraudulent enterprises."

Some of the schemes that have been used are described in a statement prepared by the National Better Business Bureau, copies of which may be obtained from the bureau at the address given above.

* * *

"MICARTA" AIRPLANE PROPELLERS

An interesting use for the well-known gear material "Micarta" has been found in the making of airplane propellers. About 1917, during a search for a better material for airplane propellers than the woods then in use, the performance of "Micarta" gears suggested that this material be tried. By that time gears were molded directly to shape from "Micarta" and it was conceived that the material could also be molded to the shape of an airplane propeller. This new application proved to be successful, and "Micarta" propellers have proved to be not only safer than wood, but more uniform in quality.

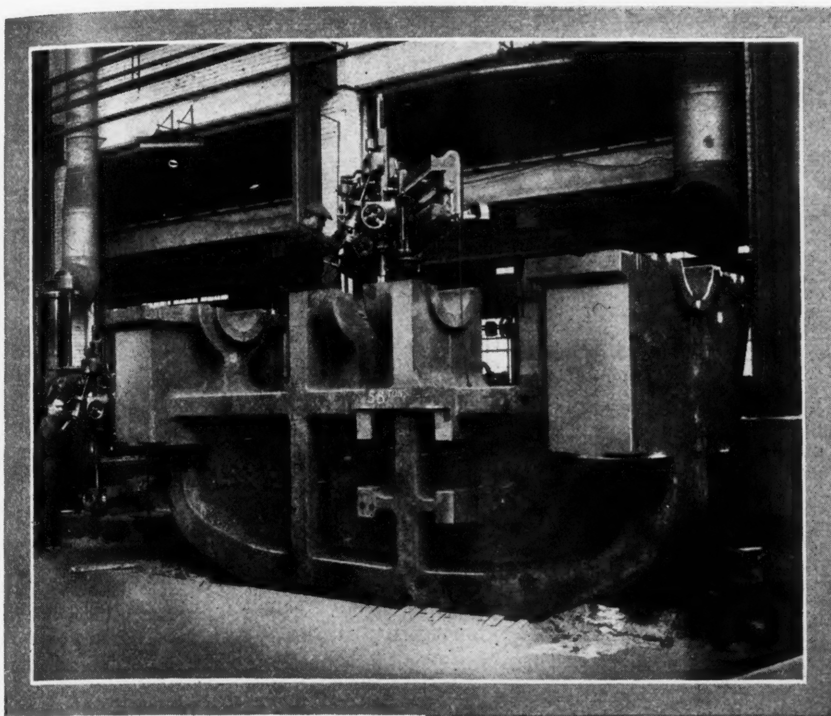


Fig. 2. Drilling Operation on the Crown Casting of the Large Bliss Double Crank Press Shown on the Opposite Page. An Impression of the Enormous Size of this Casting is Derived by Comparison with the Man in the Illustration

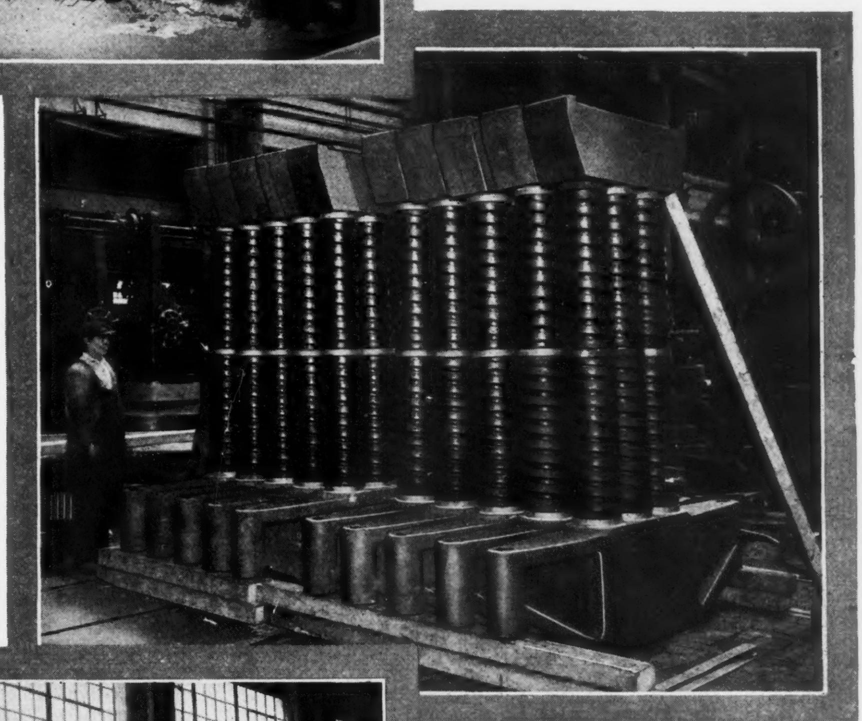


Fig. 3. Spring-pressure Drawing Attachment Assembled on the Shop Floor Ready to be Placed in the Lower Portion of the Press Bed. This Attachment has a Capacity of 350 Tons

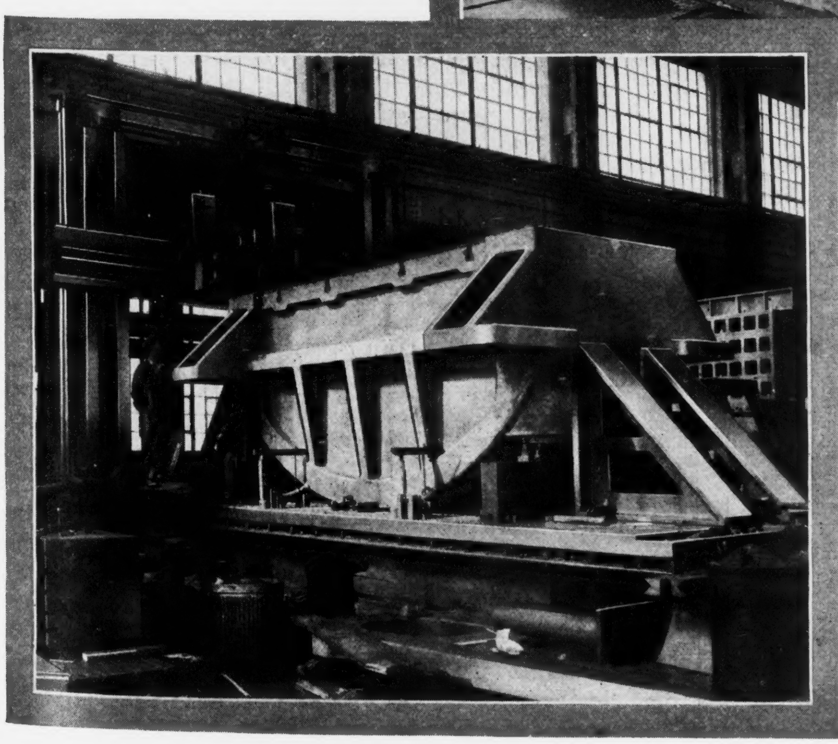


Fig. 4. Planing the Press Bed on a Planer Measuring 14 Feet between Housings. This Bed is the Largest Casting ever Produced in the Bliss Foundry. It Weighs 69 Tons

Automobile Production and Business Activity

THE reduced activity in practically all the metal-working industries during the last five months is more closely connected with the inactivity of the production lines of the Ford factories than is generally appreciated. In number of cars, the Ford Motor Co. has produced, in recent years, from 35 to 50 per cent of the total number of units built in the United States. It is not possible to practically close down one-third of the automobile producing capacity of this country and expect that other industries will continue to function as usual, because almost every metal-working industry produces, directly or indirectly, something that goes into an automobile; and in addition, the automobile industry is an important factor in the operations of plants producing such products as glass, leather and other upholstery, paints, varnishes, and enamels. The amount of revenue freight carried by the railroads has also diminished, because the shipments of automobile materials, parts, and finished cars has become an important item in freight revenues.

In the metal-working industries, it is evident that sheet-steel production should suffer and that the demand for alloy steels should fall off considerably. The demand for cutting steels, both of the high-carbon and high-speed steel variety, has also declined, because the makers of tools have found that the call for their product has diminished in direct proportion to the decreased automobile production. When the Ford plant is again in full operation, which may be early next year, the demand for all these products will be automatically resumed, and active business will probably be in evidence in almost every metal-working field.

This prediction is borne out by the general belief in the steel, automotive, electrical, and harvester machinery fields, where it is expected that the early months of next year will be as active as the first six months this year.

Small Automobile Production Affects the Demand for Machine Tools

The effect of the Ford shut-down on the sales of other cars, and its influence on the machine tool and metal-cutting tool industries, is emphasized in the following statement by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association: "Present conditions in the machine tool industry are accentuated by the situation in the automotive field, which has obviously been affected by the Ford shut-down. Many potential buyers of cheaper cars have made their old cars run longer, waiting to see what the new Ford will look like. This has affected the sales of other makes in a higher price class as well, because quite a number of people have the idea that the new Ford will be a great bargain, at a low price.

"Other automobile manufacturers have been compelled to assume a position of watchful waiting to see what they will have to meet in competition; and production plans involving purchase of new machine tools have quite naturally been laid on the shelf. Then, too, the earnings of several automobile companies have not been so good during the first nine months of this year as they were last year, so there is now less purchasing power available for new tools."

When Ford Starts Production, What Will Happen?

Just what the effect will be on the machine tool industry when the new Ford car is ultimately in production is difficult to predict. Should the new car meet with popular approval and be sold at a price considerably below that of similar competing cars, thus becoming highly successful, it is obvious that in order to meet this competition, other builders of low-priced automobiles must attempt to reduce costs further, which may mean extensive re-equipment of existing plants.

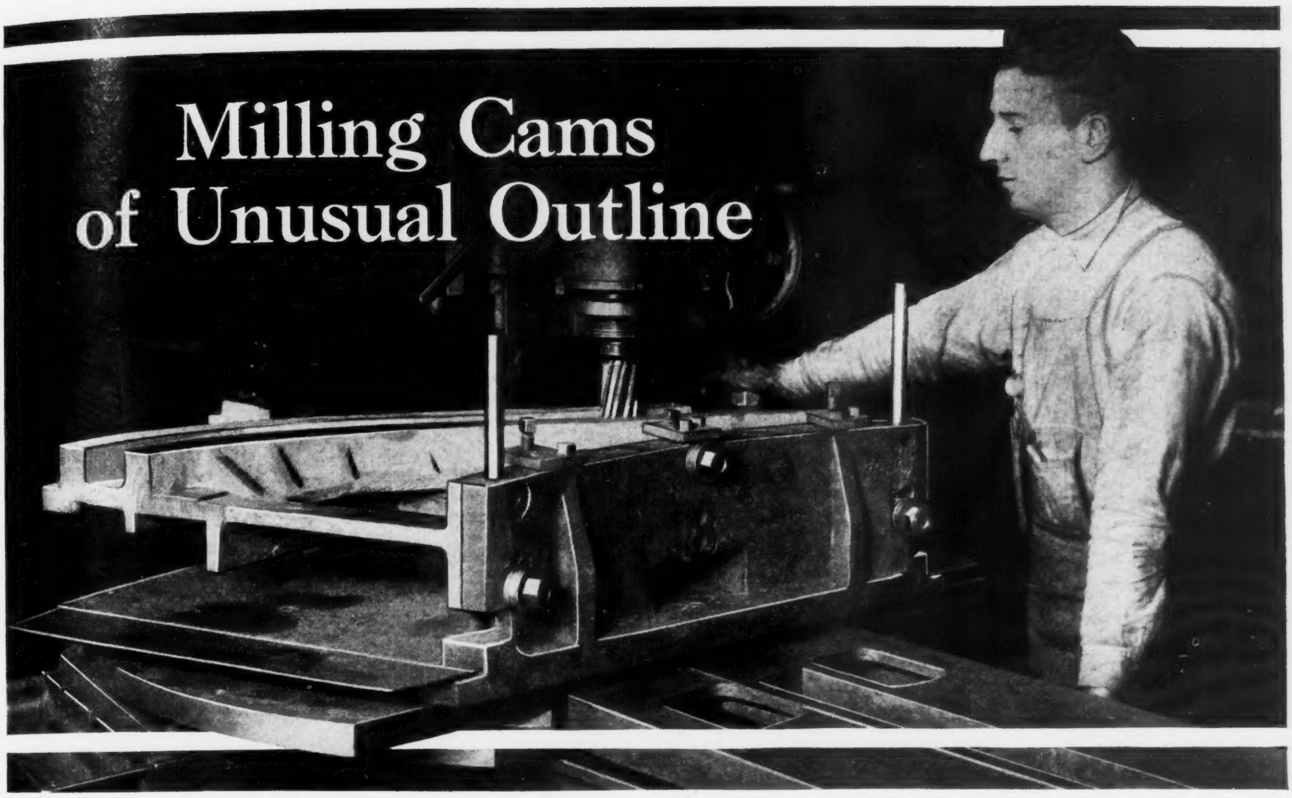
On the other hand, if the Ford car should not prove as formidable a competitor to present low-priced cars as has been believed by many, then the output of other low-priced automobiles will doubtless increase to a considerable extent, and this may require additional plant capacity.

Just how active the automobile industry will be as a buyer of machine tools in the near future is, nevertheless, problematical. Mr. DuBrul, quoted above, is of the opinion that this industry will not be so great a buyer in the machine tool market during the early part of next year as it was during the first months of 1927. On the other hand, Mr. DuBrul points out that general business is on solid ground and that the demand for machine tools from other sources, while not likely to be very brisk, still may be fairly satisfactory. Present conditions are just about those that are likely to precede a period of activity, and while business as a whole finds competition keen and earnings smaller in most cases—still, they are earnings and not losses.

Automobile Production this Year Twenty Per Cent Below Last Year's Output

Including the Ford production, the total estimated automobile output for the first ten months of this year was 3,323,800 compared with 3,992,600 for the corresponding period of 1926—a decline of more than 19 per cent. This decline is wholly due to the small production of Ford, because there was a gain of 9 per cent in the output of automobiles of other makes. It is not known definitely when large-scale production on the new Ford car will start. Early in November, slight changes on the new car apparently further delayed large-scale production, and no authoritative statements have been given out as to when the large-scale production lines, characteristic of the Ford plants, will be again in operation. It is generally believed, however, that in January the Ford plant will resume its customary activity.

Milling Cams of Unusual Outline



Typical Methods of Machining Special Cams Ordered in Small Lots

By CHARLES O. HERB

IN building special machines designed for automatic operation, the making of cams is one of the important operations. Cams for such equipment are usually ordered in small lots, and considerable ingenuity is often required to produce them in a practical and economical manner. This article will describe typical methods used by the Kent-Owens Machine Co., Toledo, Ohio, in milling cams for bottle-making and special machinery and in filling orders of individual parts contracted for on a jobbing shop basis.

Cam with an Adjustable Path

Sectional cams up to 14 feet in diameter have been produced. Fig. 1 shows a cam of this class, weighing approximately 4000 pounds, which was built for a large bottle-making machine. An interesting feature of this cam is that the unit *A* can be adjusted up to approximately 30 degrees around the main portion of the cam. The adjustment is accomplished when the cam has been assembled in the machine, by applying the pinion of handle *B* to geared segment *C* which is fastened to the adjustable section. The pinion is inserted through the hole seen at *D*. This type of cam is termed "early and late timing," because one or more throws can be positioned to change the time at which different functions of the machine are accomplished during the cycle of operation.

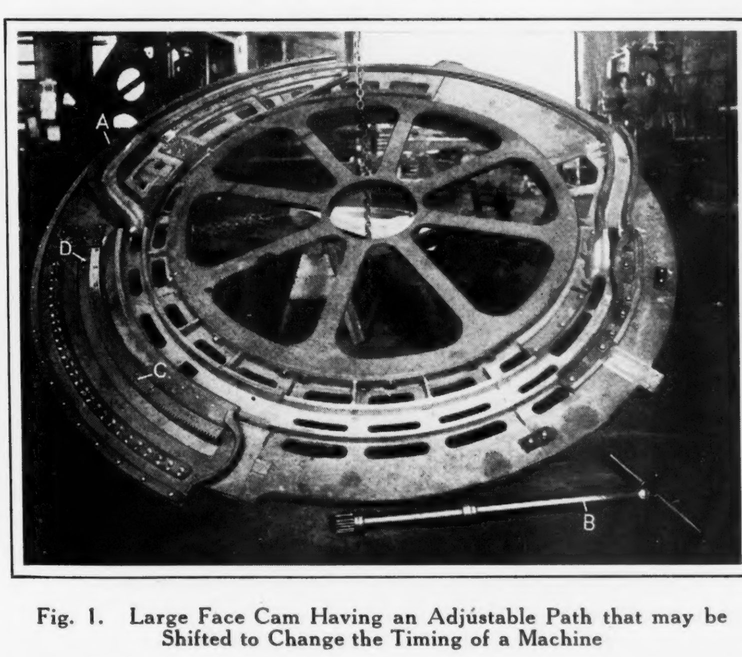


Fig. 1. Large Face Cam Having an Adjustable Path that may be Shifted to Change the Timing of a Machine

As may be seen from the illustration, both section *A* and the main unit of the cam are made up of a number of cam segments. Some of these segments are machined together before their assembly, and others individually. The back of the main unit also has a cam path.

Large face cams of the type shown in Fig. 1 usually have several sections in which the cam path is laid out to the same radius. When there are four or more sections, all of these can be conveniently turned in one operation on a vertical boring machine, but with a smaller number of sections, the "air - cutting" time would be too great to make this method desirable. The sections are then finished individually in the vertical milling machine shown in Fig. 2 and in

the heading illustration.

Bolted to the saddle of this machine there is an arm *A* which is supported at the outer end by stand *K*. The stand is vertically adjustable to the desired table height. On the standard table of the machine, there is a sub-table *C* having a circular machined tongue on each end which slides in a groove formed by a bracket *E*, which is fastened to the corresponding end of the standard table of the machine. Attached to sub-table *C* is an arm *D* which extends over arm *A*.

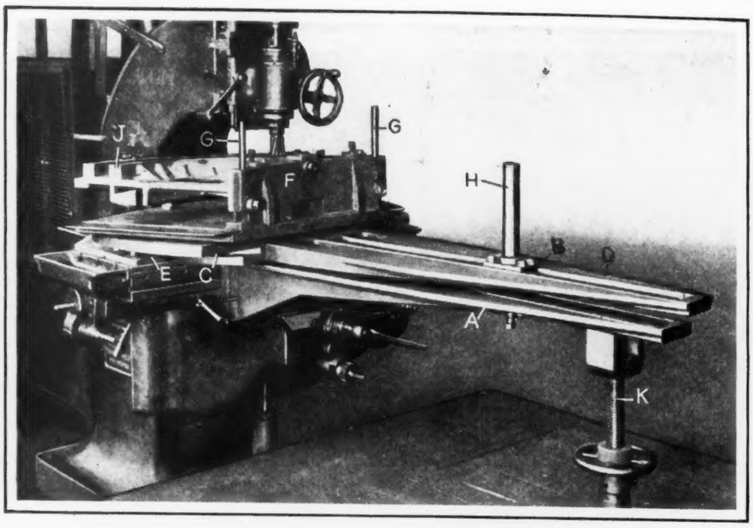


Fig. 2. Machine Employed for Milling Cam Sections

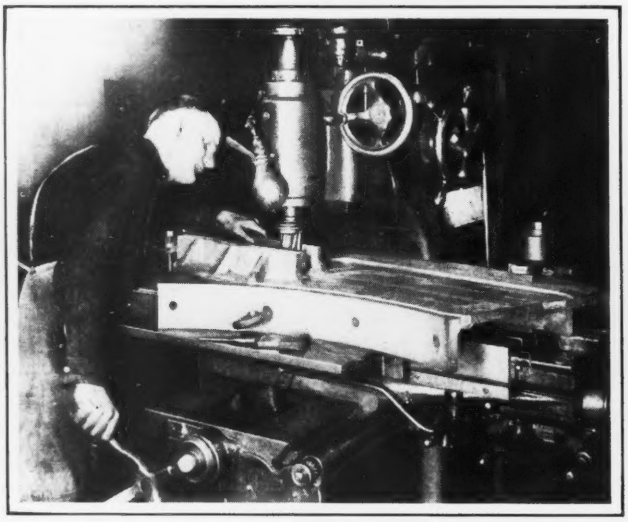


Fig. 3. Milling a Cam Path by Following a Scribed Line

Fig. 4. Using a Power-driven Circular Milling Table

In each of the arms there is a longitudinal slot along which the two-part pivot block *B* may be positioned. The lower and upper parts of the pivot block are clamped in arms *A* and *D*, respectively, at the desired radius from the cutter. Sub-table *C*, on which the work is held, is then free to swivel about post *H*, contained in the pivot block *B*.

Special fixtures of the general design illustrated at *F* are employed on the sub-table for holding the cams to be machined. These fixtures are equipped with two posts *G* which are used in conjunction with post *H* of the pivot block to set the latter in the proper position along arm *A* for swiveling the cam at the desired radius past the milling cutter. An inside micrometer with an extension rod is employed for determining the distances between posts *G* and post *H*.

A typical cam is shown in the fixture at *J*. An accurate set-up is obtained by bolting a previously finished surface to the front wall of the fixture and clamping a bottom edge of the cam to the fixture. In the milling operation, the table is fed in either direction in the ordinary manner. Both roughing and finishing cuts are taken on the work, and only one side of the cam path is milled at a time.

Equipment similar to that used on this vertical milling machine is employed on a planer for machining large work having a cam path so short that a considerable amount of time would be wasted in "cutting air" if the operation were performed on a boring mill.

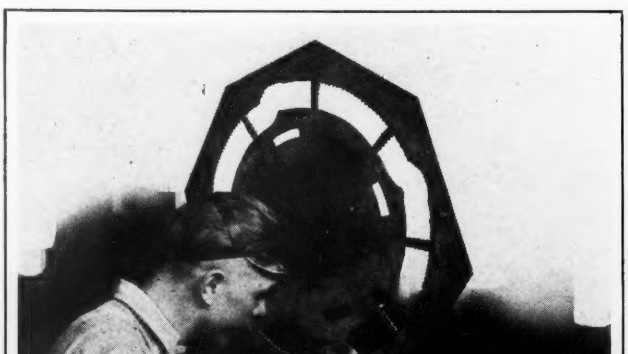


Fig. 5. Filing a Templet Used in Laying out Cam Paths

Cams Milled to Different Radii

Many sections of large face cams have paths that must be machined to more than one radius. Such cam paths are carefully laid out to a templet and then scribed on the work. The milling is next accomplished on a vertical machine in the manner illustrated in

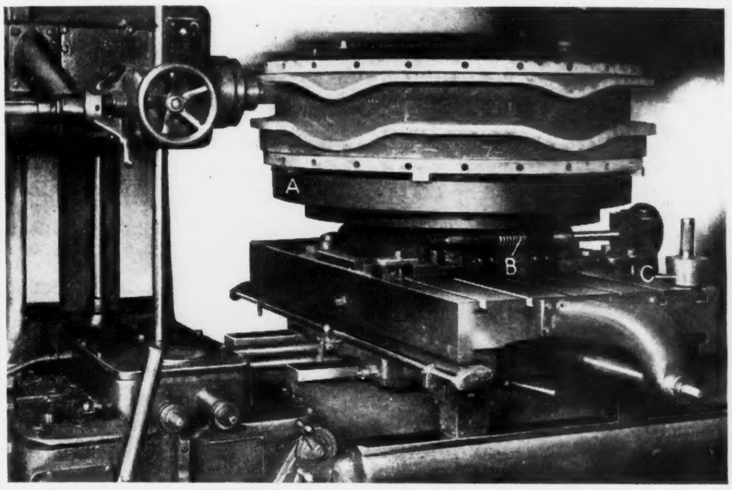


Fig. 6. Equipment Employed in Machining a Large Drum Cam Having a Tapered Path

Fig. 3. In such an operation, the longitudinal power feed of the table is employed in conjunction with the transverse hand feed of the saddle. Roughing and finishing cuts are also taken, and only one side of the path is machined at a time.

Circular milling tables are employed in producing complete face cams of the kind that may be seen on the machine illustrated in Fig. 4. After a job has been set up, a dial indicator is applied, to make certain that the perimeter of the cam revolves concentrically with the table.

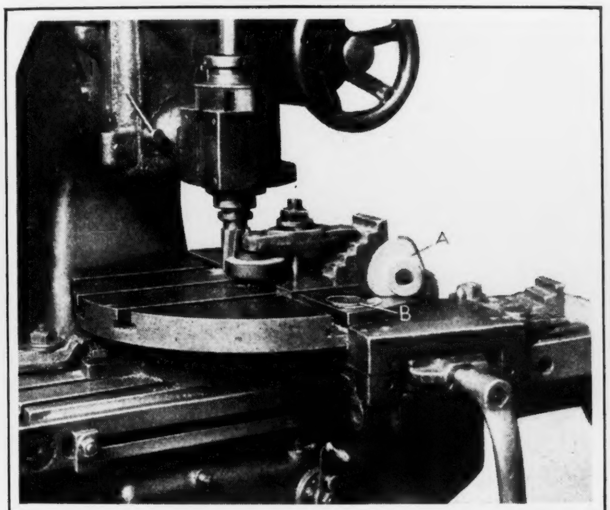


Fig. 7. How Plate Cams are Produced in Small Lots

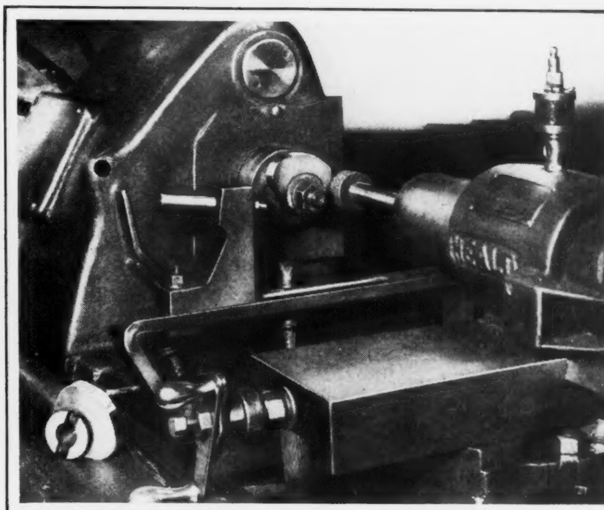


Fig. 8. Grinding Cams Milled as Illustrated in Fig. 7

In the milling operation, the power feed of the circular table is used for revolving the work past the cutter, while the longitudinal table is shifted by means of the hand adjustment to change the position of the work so as to obtain the different cam throws. Jobs of this sort are also first laid out from a special templet. Roughing cuts are taken to approximate the cam path, and these are followed by finishing cuts to obtain the desired accuracy.

Fig. 5 shows a workman engaged in producing a typical cam templet. Ordinary black sheet iron from 3/32 to 1/4 inch thick, depending upon the size of the cam, is generally used for this purpose. The cam path is carefully laid out on this sheet, holes are drilled along the scribed lines, the inside pieces knocked out and the excess metal along the lines is finally filed away to the scribed lines. When completed, the templet is clamped to the work and lines are scribed on the latter by following the openings of the templet.

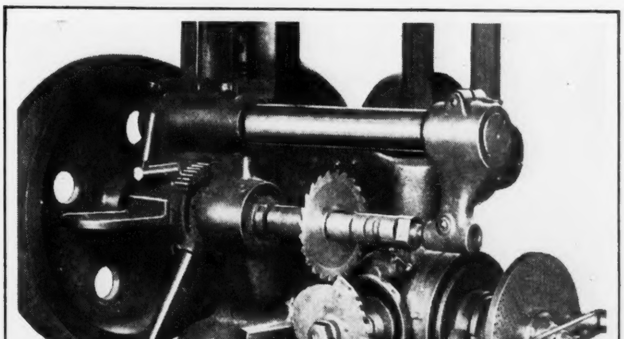


Fig. 9. Cutting Thirty Steps on a Small Plate Cam

Large drum cams are usually handled on the horizontal boring, milling, drilling, and tapping machine shown in Fig. 6. This machine is equipped with a special circular table *A*, mounted on a base which is clamped to the regular machine table. Fastened to the under side of table *A* is a large worm-gear which is driven by worm *B*. The worm is mounted on a shaft to which power is transmitted by means of sprockets and a link chain from a shaft extending along the center of the bed.

Before the operation of milling such a cam is started, the cam path is carefully scribed from a templet, as in the case of the operations already mentioned. In the milling operation, power is employed to revolve the table, and the cutterhead of the machine is raised and lowered by means of the hand feed in order that the cutter

may follow the scribed cam outlines. Each side of the cam path shown tapers 3 degrees, and the width of the path along the outside is 3.500 inches. Limits of plus or minus 0.002 inch were specified on the width of the path around the entire cam. The path was checked by means of gage *C*.

Roughing cuts were taken successively on the two sides of the cam path and then finishing cuts, the cutters being ground to the angle of the sides. The particular work shown in the illustration is an iron casting.

Cutting a Plate Cam with Thirty Steps

Small plate or disk cams having a large number of steps or rises at many different radii from the center have been conveniently cut on a hand milling machine by employing the set-up shown in Fig. 9. The work seen at *A* has thirty steps or rises, and these had to be produced accurately as to circumferential relation as well as radially. The actual radial distances from the center of the cam were not very important, but the differences in the radii were held to within limits of plus or minus 0.001 inch.

Prior to such a milling operation, radial lines are scribed the required number of degrees apart on the face of the cam and the various steps are marked off. Then the central hole in the cam is drilled and reamed, so that the cam can be mounted on the standard dividing head *B*. This dividing head permits of accurately indexing the cam according to the spacing of the steps. With each indexing, however, it is necessary to raise or lower the work relative to the milling cutter, in order to obtain the desired radius of the respective steps. This is accomplished by turning the crank of the table knee.

Accuracy of each vertical setting is checked by slipping gage-blocks beneath the spindle of dial indicator *C*, which is fastened to a bar bolted to the column of the machine. Each step is milled at right angles to an imaginary line struck radially from the center of the disk to the center of the step. The surfaces between the steps are milled in the same machine, up or down as the case may be. For the milling operation, the table is reciprocated back and forth by means of the regular hand feed. The milling cutter is ground to a special clearance angle.

Fig. 10. Laying-out Operation on a "Serpentine" Cam

Milling and Grinding Simple Cams

Simple plate cams of the design shown at *A* in Fig. 7 are milled in a vertical machine arranged as shown. The outline of the cam is first scribed from a templet, such as illustrated at *B*, and then the part is clamped to the circular table in the manner illustrated. The hand-crank of the circular table is employed to feed the part past the cutter according to the scribed outline. Obviously, two clampings of the part are necessary in each operation, but the method is desirable in view of the few identical cams produced.

Grinding of the contour of such cams is accomplished in a lathe equipped with a Heald grinding head and a Landis cam grinding attachment, as illustrated in Fig. 8. A master cam of the same contour as the work, which is mounted in the grinding attachment, is employed to feed the work transversely relative to the grinding wheel as it is revolved. It will be seen that a truing diamond is mounted in a special holder, which may be adjusted crosswise of the lathe bed. The cam is hardened prior to this grinding operation.

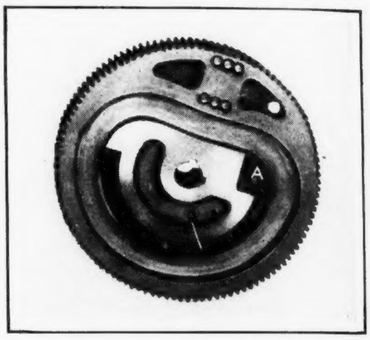


Fig. 11. Cam Provided with Steel Inserts

A "Serpentine" Cam

Many "serpentine" cams having a twisted cam track, as illustrated in Fig. 10, are made. These cams are milled on each end and assembled in a circle around some machine member to form a long continuous cam. The entire cam track is then ground smooth by means of a portable electric grinder, to insure proper contact of the roller which runs on it.

Fig. 10 shows a workman engaged in laying out the ends of a cam prior to milling them. Before the laying out is started, the surface plate on which it is to be done is coated with whiting. Then two radial lines are drawn on the plate the required number of degrees apart from a post which is located on the shop floor a predetermined distance from the surface plate. The cam is next set up, as shown, with the ends parallel to these radial lines.

Two lines are then scribed on each side of the cam casting at both ends. One of these lines is laid out in the same vertical plane as the corresponding radial line on the surface plate, and the second line is scribed parallel to the first a short distance in back of it. The second line furnishes a means of checking the milling operation performed along the first line. The laying out and milling of these ends must be performed accurately, so as to permit proper assembly of all cams.

Steel Inserts Increase Cam Life

Inserts or liners made of steel are frequently used along cam paths in places where the metal tends to wear away rapidly. Fig. 11 illustrates such an example. It will be seen that the cam

groove is cut in the face of a spur gear and that steel inserts have been provided at *A* and *B*. Similar cams have been made with the inserts extending the entire length of the cam path. These inserts are milled to the desired outline after being assembled, a vertical milling machine being employed in the same manner as illustrated in Fig. 4, after the path has been laid out to a templet.

Steel inserts are used in many instances in cams of the construction shown in Fig. 1, because they not only increase the life of a cam, but also can be conveniently replaced when worn. Many cams originally made without steel inserts are repaired by their use. Sometimes the inserts are hardened.

* * *

STAMPING DIE WITH THREE HUNDRED EJECTOR-PINS

Over 300 ejector-pins are employed in a die set recently built in the shop of A. J. Sossner, 361 West Broadway, New York City. This die is designed for blanking intricate trademark stampings, such as that shown at *A*, Fig. 1. The punch and die members are shown at *C* and *D*, Fig. 2, respectively. Brass stock from 1/32 to 1/16 inch thick is blanked, the operation being performed on a 60-ton power press.

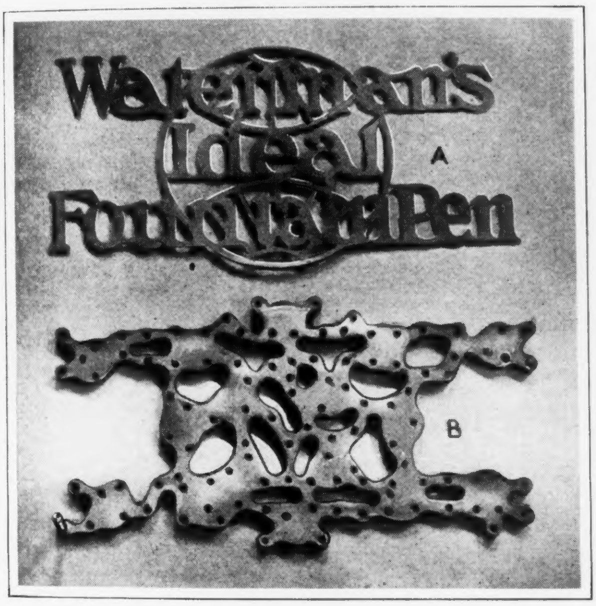


Fig. 1. Stamping Produced by, and Frame Used in, Die Shown in Fig. 2

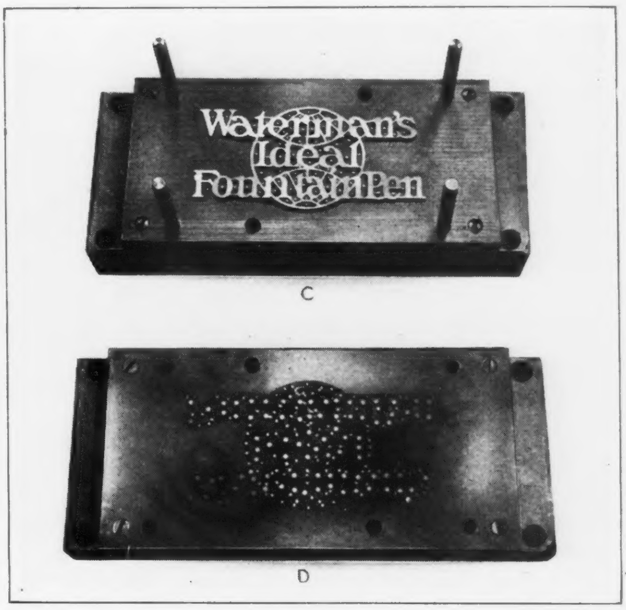


Fig. 2. Die Employed in Blanking the Part Shown at A, Fig. 1

In making the punch and die parts, the lettering was first carefully scribed on high-carbon steel plates, 7/8 inch thick. Then, in the case of the punch, the metal was routed away around the lettering, leaving it in relief, as shown at *C*, Fig. 2. The lettering of the die was routed out, leaving it depressed, as seen at *D*. The depressions or grooves were made twice the greatest thickness of the metal to be stamped.

These routing operations were performed in a vertical milling machine equipped with a strong magnifying glass, which made it possible to follow the routing tool closely. Each edge of the lettering was gone over several times until it became smooth and polished. The parts were then hardened and surface-ground. The face of the punch was ground slightly convex, so as to cause the blanking to take place gradually, starting at the middle of the die.

With a die set of this type, the stamping would be likely to stick to the face of either the punch or the die, unless adequate means were provided for removing it. This was accomplished by employing about 100 ejector-pins in the punch and 200 in the die. The pins of the punch are positioned in the spaces between the raised lettering, while those of the die are located in the lettering grooves.

All the ejector-pins extend through the punch- or die-plate, as the case may be, and enter a frame such as shown at *B*, Fig. 1. One of these frames is contained in a recess in the bolster to which the punch- or die-plate is fastened. Coil springs back up the frames, and as the holes for the ejector-pins do not extend through the frames, the pins are pushed out through the punch and die with each return stroke of the ram, thus preventing the stamping from adhering to either the punch or die.

When set up in the press, four guide pins hold the punch and die in accurate alignment. Dies of this design could be constructed for producing many stampings of the same general nature as that here shown.

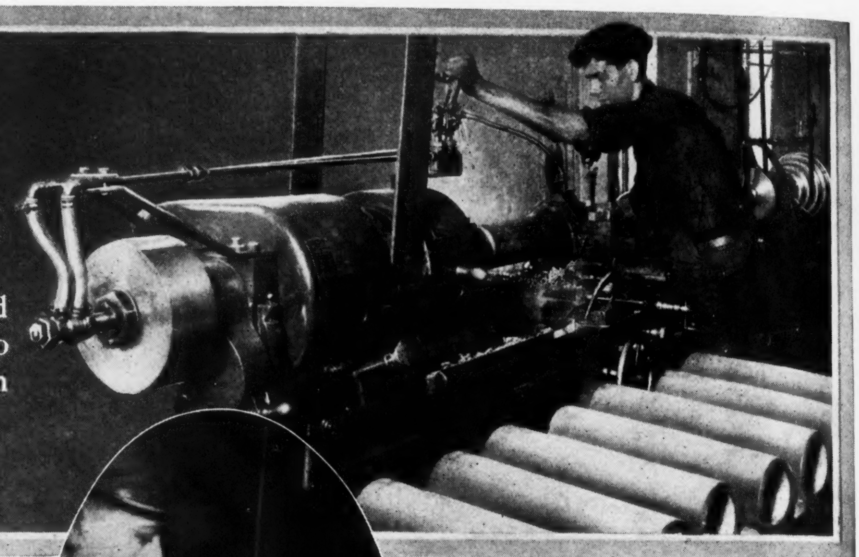
* * *

POWER AND ENGINEERING EXPOSITION

The sixth annual National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace, New York City, during the week beginning December 5—the same week as the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers are held. Four floors of the Grand Central Palace will be completely filled with exhibits, over five hundred exhibitors being represented. The exhibits will cover boilers, stokers, furnaces, superheaters, valves and accessories, heating and ventilating equipment, refrigeration machinery, power transmission devices, machine tools and woodworking machinery, and instruments for measuring and recording pressures, temperatures, gas and air flow, etc.

Air Chucks and Fixtures

Pneumatically Operated Equipment Designed to Save Time and Labor in Quantity Production



SEVERAL milling fixtures of the indexing type, which have been built by the Hannifin Mfg. Co., Chicago, Ill., have been described in previous articles of this series. Another fixture of this classification, designed to permit three pieces to be milled simultaneously, is illustrated in Fig. 3. There are three separate work-holding units equipped with individual air cylinders and pistons, but these three units are indexed and locked at one time and the chucks are operated simultaneously.

Each piece of work is slipped into a nose-piece *A* and the greater portion of the shank entered into a collet *B*. The split sections of the collet are pressed firmly on the work when the collet is advanced into the nose-piece through pressure exerted by the hollow piston-rod *C*, as air is admitted in back of piston *D*. Air is, of course, admitted on the front side of the piston to withdraw the collet from the nose-piece. As the work is released, a jet of air escapes to the center of the piston-rod in back of the head on the left-hand end of rod *E*. This forces the rod to the right, causing the work to be ejected from the collet.

The entire mechanism of each unit is indexed with sleeve *F* when the latter is revolved to permit pin *G* to enter the various index-holes around the sleeve. Unlocking of pin *G* of the three units is accomplished simultaneously by merely pulling handwheel *H* forward, thus drawing three wedges under the left-hand half of hinged levers *J*, as seen in the sectional view. Then handwheel *L* is revolved, which turns cylinder *M*, sleeve *F*, and the entire mechanism of each unit until a new index-hole has been brought into position beneath pin *G*. Handwheel *H* and the wedges are next

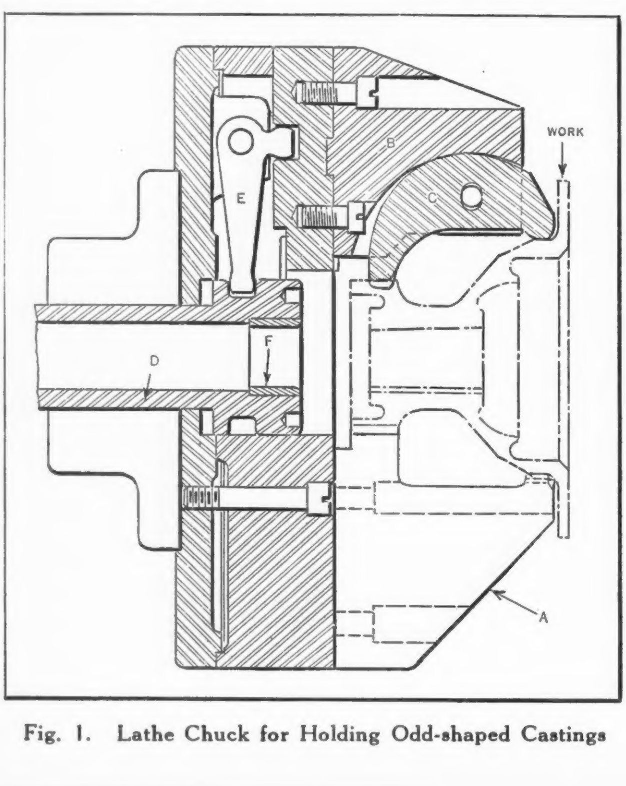


Fig. 1. Lathe Chuck for Holding Odd-shaped Castings

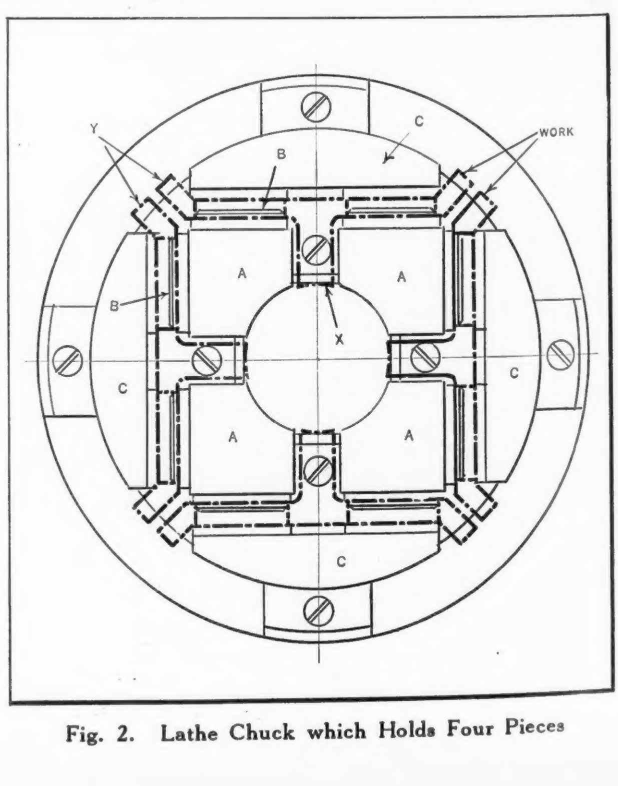


Fig. 2. Lathe Chuck which Holds Four Pieces

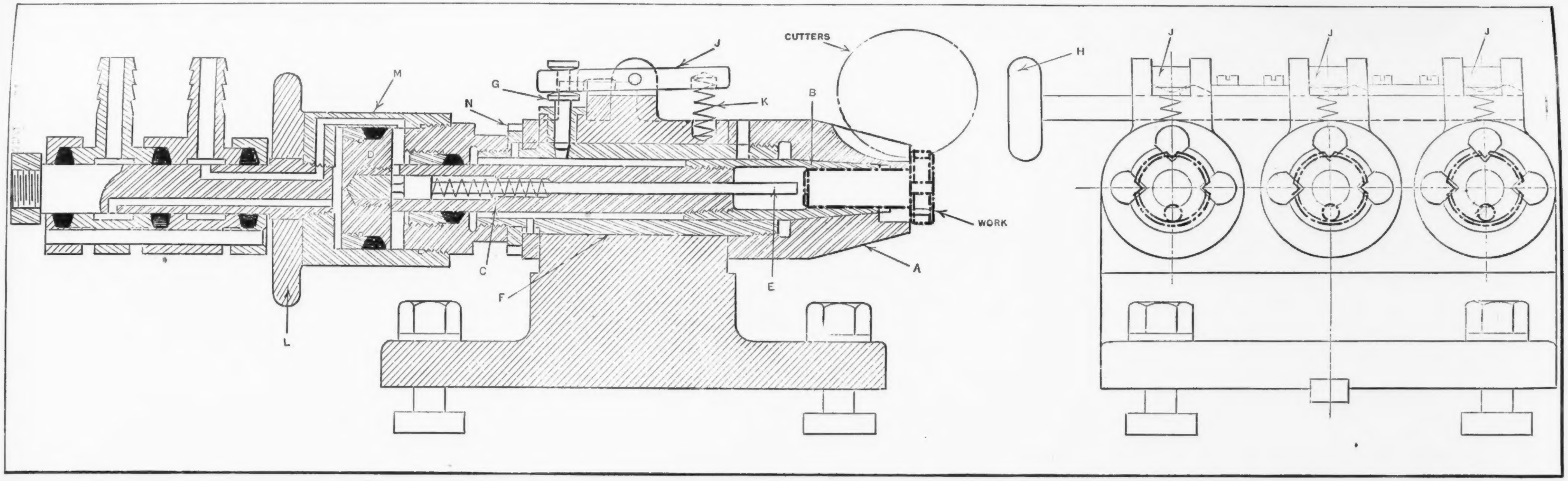


Fig. 3. Three-spindle Fixture with Novel Indexing and Locking Means

pushed back again, permitting coil springs K to force pins G into the index-holes of sleeves F which are directly beneath them. There is only one handwheel L, the three units being connected through gears N. Three grooves are milled in each piece of work.

Chuck for Rough Castings

Rough castings can be held by means of the lathe chuck shown in Fig. 1 for various turning, facing, and boring cuts. The chuck is of the three-jaw type, two jaws being of the design shown at A, while the third jaw B is equipped with a hinged member C that swivels to suit the shape of the work as the three jaws are fed radially toward each other.

Feeding of the jaws toward and away from the work is accomplished by moving hollow rod D to the left and right, respectively, the movements of rod D being imparted to the jaws through three bellcrank levers E. Rod D is connected to the piston-rod. A pilot on the front end of the tool-bar employed in this operation enters bushing F to hold the tools steady.

Lathe Chuck which Holds Four Pieces Simultaneously

Four castings of the outline shown by the heavy dot-and-dash lines in Fig. 2 are held in a lathe chuck as indicated, for an operation which consists of boring each lug X to a common radius and turning each leg Y concentrically. These castings are 3 3/8 inches high, about 5 3/4 inches long over all, and approximately 2 inches wide over all. The body of the chuck closely follows the construction of the chuck illustrated in Fig. 1, with the exception that there are four bellcrank levers and sliding jaws instead of three. Operation of the bellcrank levers and sliding jaws is accomplished in a similar manner.

Fastened to the body of the chuck, there is a plate on which four posts A are mounted. These posts are all stationary and are equipped on two sides with large hardened steel buttons B. Cored openings in the castings fit over these buttons for locating purposes. When four castings have been placed in the chuck as shown, air is admitted into the cylinder of the chuck to advance the four jaws C against the outside of the pieces, thus holding them rigidly for the operation.

Before this chuck was designed, the pieces were held in a fixture by means of set-screws. Obviously, the air-operated chuck permits a great saving in reloading time.

Fixtures for Radial Drilling Machine

Four fixtures of the construction illustrated diagrammatically in Fig. 4 have been designed for use in conjunction with a radial drilling machine. These fixtures are spaced around a special bed in such a manner that an operation can be performed on work in one fixture while the others are being reloaded. The operation consists of taking a facing

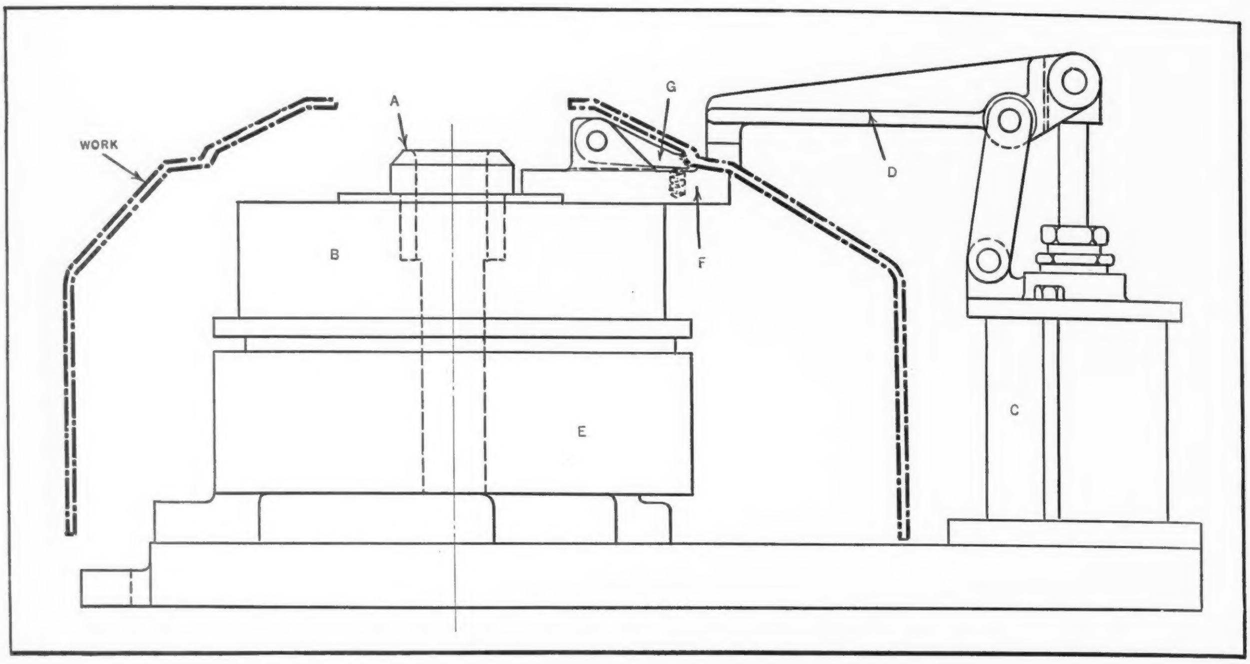


Fig. 4. Fixture Used in a Group of Four Beneath a Radial Drilling Machine

cut on the bottom surface of large washing-machine tub castings by means of a cutter piloted in bushing *A*. This bushing is contained in the center of chuck *B*. Spaced around each chuck unit are three non-rotating air cylinders *C*, each of which operates a hinged jaw *D*. Beneath chuck *B* there is another non-rotating air cylinder *E*.

After a casting has been placed on the chuck, a control valve is operated to admit air above the piston in cylinder *E* and below the pistons of the three cylinders *C*. The subsequent movement of the piston in cylinder *E* causes three jaws *F* and their hinged members *G* to move radially outward on chuck *B*. Hinged members *G* have serrated ends which serve to locate the casting concentric with bushing *A*. At the same time hinged jaws *D* are swiveled down on the outside of the casting through the movement of the pistons in cylinders *C*. These jaws hold the casting securely on jaws *F* for the operation. When air is admitted on the opposite sides of the pistons, jaws *D* are swung upward approximately 90 degrees, and jaws *F*, with their hinged members, are drawn toward the center of the chuck. The work can then be readily replaced.

Air-operated Clamps for Cylinder Blocks

Air equipment of the design illustrated in Fig. 5 has been incorporated in fixtures employed for holding combined cylinder blocks and crankcases. The equipment for one cylinder block and crank-

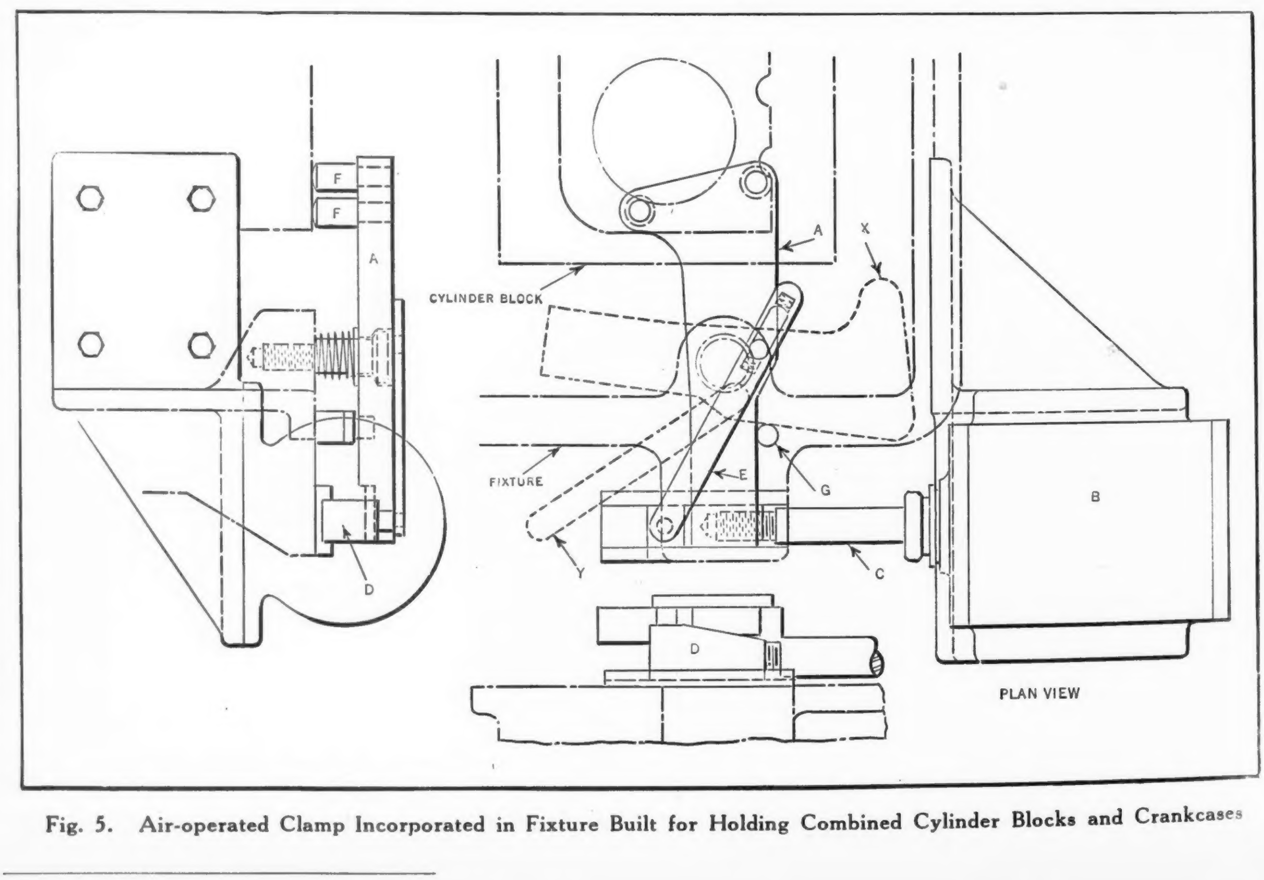


Fig. 5. Air-operated Clamp Incorporated in Fixture Built for Holding Combined Cylinder Blocks and Crankcases

case consists of two clamps A and the mechanisms required for operating them. When the fixture is being loaded, both clamps are drawn back, as indicated by the dotted lines X. Then, after the loading has been completed, air is admitted on the front side of the piston contained in cylinder B to pull rod C to the right, as viewed in the illustration.

This movement of rod C causes wedge block D to pull link E from the position indicated by the dotted lines Y into the position shown by the full lines. Link E gives a sudden movement to clamp A so that the tail end of the clamp swings into position ahead of the wedge block until the clamp strikes pin G. As the air piston completes its movement, the wedge block is pulled under the clamp, which is then stationary, and tips the tail end of the clamp upward a slight amount, pressing pins F firmly on the top of the cylinder block. Pin G also functions to stop the clamp when it is swung open.

Large Press for Celluloid Parts

A press designed for exerting pressures up to 60 tons on celluloid parts is illustrated in Fig. 6. The stroke of ram A and of ram head B is 1 inch, and the pressure reaches the maximum amount approximately 1/8 inch from the bottom of the stroke, suitable dies being, of course, provided for holding the work. Cylinder C has a bore of 8 inches, and a pressure of 2 tons is exerted on the piston with an air line pressure of 80 pounds per square inch. The piston stroke is about 14 inches, and the over-all height of the equipment, 7 feet.

Air is admitted into cylinder C to pull the piston downward when it is desired to exert pressure on the work. As the piston is forced downward, it swivels link D, and this member makes links E and F assume vertical positions, forcing the ram and ram head downward on the dies in which the work is held. The lower end of the ram is threaded and screwed into a tapped hole in the ram head. This construction provides for closely adjusting the head along the ram. Many applications could be made of this type of equipment. The fourth article of this series appeared in November MACHINERY. The present article concludes the series.

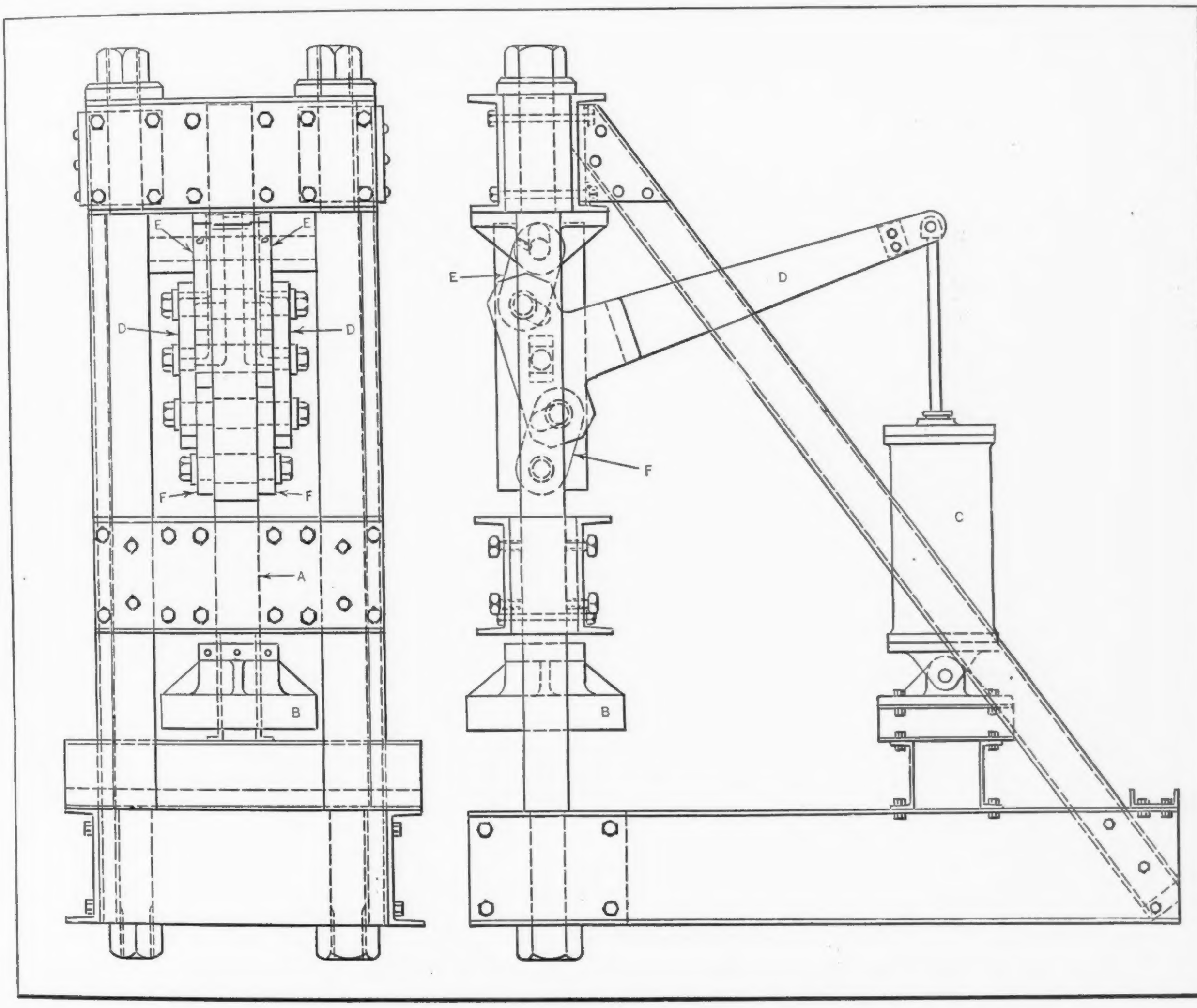


Fig. 6. Construction of Air-operated Press which Delivers a Pressure of Sixty Tons

* * *

The University of Illinois has founded a professional honorary fraternity in the industrial management field known as Sigma Iota Epsilon. The purposes are to arouse and foster a greater interest in industrial and business management on the part of undergraduates and graduate students in the colleges and universities of the country; to provide a suitable recognition of scholastic achievements in this field; to attract to industry a greater number of outstanding men; and to carry into business and manufacturing enterprises a recognition of the worth of scholastic achievements.

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

VACATIONS—BUNCHED OR STAGGERED?

Whenever anyone suggests vacations for the foremen of the shop departments, the question is raised, "What is going to happen to production?" One shop with 1000 employes answers that question by setting aside two vacation periods of two weeks each, during which all the foremen and sub-foremen, as well as the office force, are given a vacation, half of the force going at each period.

Most shops have some dull season during the year, even if it is in the middle of the winter, and at that time vacations would not seriously affect production. Several years' experience with the vacation policy mentioned has convinced the writer that "bunched" vacations break up production less than the old staggered plan.

And after all, if the office executives can take vacations without interfering with the running of the business, but the foremen cannot be spared, doesn't that make the foreman the most important man in the shop? CHARLES SPRAGUE HAZARD

INSTRUCTION FOR INSTRUCTORS

The questions often asked, "Are we becoming too academic in our engineering education?" and "What can we do to further the cause of engineering education?" leads me to think that the greatest benefit to engineering education is to drive the educators out into industry for a period of time. They should be in close touch with industry, so that they may be able to follow the progress in their particular field.

I had an experience recently that was amusing as well as instructive. The writer, at his usual occupation, teaches mechanical drawing. After having taught for a few years, the thought came to me that possibly I was becoming petrified, to use a hard term, in my conception of the subject. There was the possibility of my becoming overly academic and possibly slighting something very important. To overcome this feeling, I tore away from the chains of summer school, and delved into the realm of industry. My first visit was to a machine shop where I eagerly sought the superintendent. After explaining to him that I wanted to get work for the summer for the purpose of "learning" something, he laughed and then yelled to the foreman: "Hey, Diogenes, throw away your lantern, here's a school teacher that wants to learn something."

In the light of this experience, the thought came to me that probably there are a few drawing teachers, as well as machine shop and pattern shop teachers, who are unaware of a possible rut out of which they might find it hard to extricate themselves. It is the opinion of the writer that instructors of all industrial subjects should spend some of their spare time out in the field of their line of work. JOHN HOMEWOOD

CONVENTIONALIZED DRAWINGS

Where conventions or symbols representing certain parts or processes have been thoroughly standardized in an industry, a great deal of time can be saved by using these symbols to represent the respective parts on drawings, and concentration on the really important phases of the designs will result. In structural steel work, for example, the symbols for field and shop rivets, countersunk heads, etc., have been so well established that they are taken for granted by all concerned. In piping lay-out work, there are symbols for the various types of valves, cocks, unions, tees, elbows, etc. In topographical drafting, there are symbols for bridges, various types of roads, railroads, fences, etc. In electrical lay-outs, there are symbols for ammeters, voltmeters, generators, motors, etc. In other industries, conventionalized details are being used to an ever increasing degree, but unfortunately there are no universally accepted symbols available. In general, there are symbolized cross-sections for various materials of construction such as wood, brass, iron, and steel.

To take full advantage of the savings possible with conventionalized drawings, one concern has prepared a complete list of all the symbols relating to the various products. These were printed, and a copy accompanies every set of drawings sent outside of the plant. Inside the plant, printed copies of the symbols are posted in convenient places for reference. This manufacturer has carried symbolizing even further than has been done in the individual industries in which they apply. It has been found possible to apply symbols to ordinary mechanical movements, gears of various types, shafts, levers, etc., and to wood construction symbolizing types of joints, dovetails, miters, etc.

A little thought applied to this phase of drafting work in a company building a variety of products will show large possible savings.

LEON J. LICHTENSTERN

WHAT IS EXPERT ADVICE?

The present time is known as the age of specialization; practically every field of endeavor has its specialists. It is but logical that the man who devotes his entire time to one branch of a trade or profession should become more proficient than the man whose time is divided among several branches. This has led to what may be termed the "craze for specialization." When something goes wrong with any manufacturing process, the tendency of the manufacturer is to seek "expert" advice—in other words, to call in a specialist in that process or branch of the industry. This is all well and good—when we are ill, we call a physician; when we need legal advice, we consult a lawyer; but the demand for specialists has become

so great that apparently many incompetents have tacked the title "specialist" to the end of their names.

The writer's personal experience with "specialists" has been so unsatisfactory that he is beginning to view all so-called "specialists" with suspicion. The following will bring out the point more clearly. A steel treating expert, after giving expert advice to a workman as to the proper method of hardening a die so as to avoid distortion or cracking, completely ruined the die by following his own advice. The writer has heard a specialist in conveying machinery recommend the use of a certain part as being capable of giving at least a year of service under existing conditions, when the part was practically worn out after five hours of continuous operation. An electroplating expert added a chemical to a tank of valuable plating solution, against the advice of the foreman of the department; the solution had to be poured into the sewer.

An expert in electric spot welding insisted that two pieces of a certain metal could not be welded under any conditions, but the foreman of the department had been successfully welding these parts for some time. An expert, called in to examine an electrical signaling device, ordered that a certain part be removed and shipped 300 miles for repairs, resulting in the idleness of the equipment for at least several days, whereas the shop foreman made the repair in less than an hour by the replacement of an entirely different part. The writer has heard a specialist ridicule a workman for a suggestion, when after the loss of several hours time, the specialist was forced to act on the workman's suggestion, which proved successful. In most of these cases, the foreman or workman was powerless to interfere, as highly paid advice was considered better than that which could be obtained from the regular employes.

The writer does not mean to belittle the efforts of the man who is truly an expert, but it is high time that executives realize that practical experience has its value, and that many problems could be solved by the man in the shop, without securing expert advice from one who is loaded up with theories but lacks the practical experience necessary to make the theories of value.

R. H. Kasper

TECHNICAL REPORTS—WRITTEN AND ORAL

Much of the success in shop management depends upon striking a happy medium in the amount of written matter sent from one department to another. I do not refer to orders or "tickets," but as the title states, I am concerned only with technical reports such as are made out by assistants for perusal by the manager or his immediate subordinates, according to the size of the concern.

Any factory of some size keeps a staff of technical assistants who are supposed to go into the difficulties of production, design, and the like, and generally get everyone possible "out of a hole." The point in question is how much writing should these men do and how much can they leave as oral advice or instructions?

Let me give examples of both sides. In factory No. 1, very little written work is done. If the foreman of the milling section finds trouble in machining the flats on part number XV234, he looks around for Mr. So-and-So, who deals with such cases. The latter gentleman looks at the job and ventures an opinion that if the sequence of operations were changed, the trouble would not exist. Such a procedure entails the making of a new fixture and therefore causes delay. While this fixture is being made, Mr. So-and-So sees the piece-rate man, who alters the payment for the difficult operation to fend off trouble for the time being. Thus the job is settled. No record is made, but the job progresses all right.

In the other shop, Mr. So-and-So receives his report on the failure in the comfort of his chair. He slips it into his "live" file and lets it take its place in strict rotation with the others. When the turn comes, he goes down to the milling section and sees the foreman and the job. He makes no suggestions, but states that he will look into the matter. Back in the office he gets out his pad and pen and proceeds to compile a report—I almost said a novel. You all know what a delightful business it is writing about shop operations, even when you know all the facts of the case. Everything has to be put in such a careful manner, in order not to offend the heads of the different departments concerned, that the whole thing when finished contains scarcely a single definite statement.

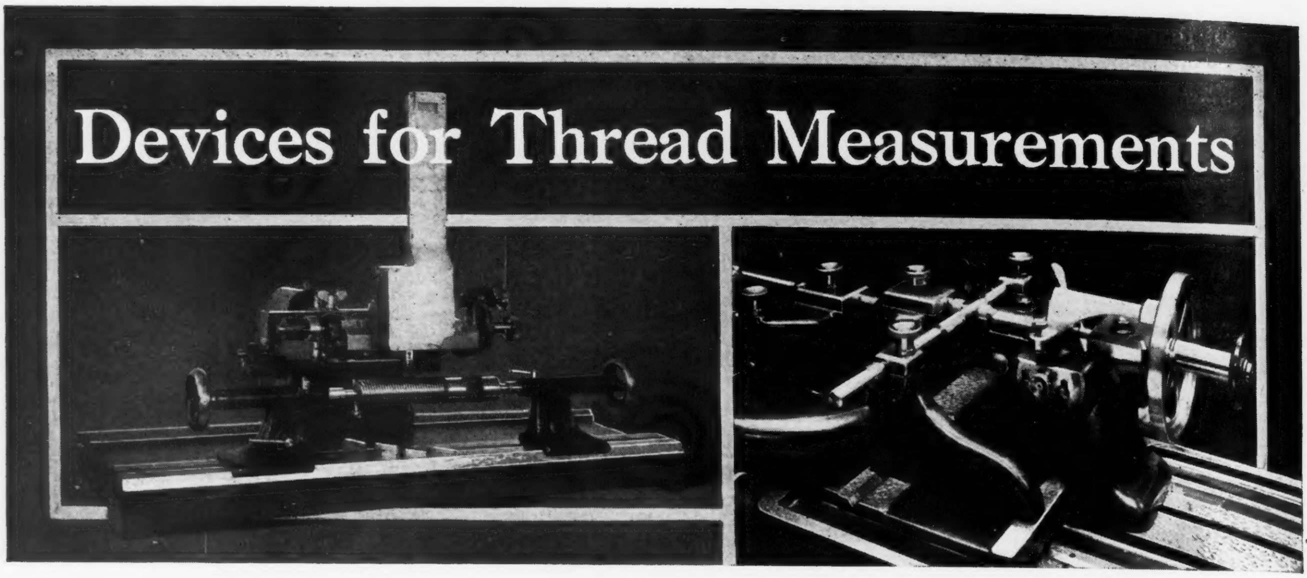
When the manuscript of the report is made out, a typewritten copy, with duplicates for the file, has to be elicited from the typist, who spends two or three days on the job. Then comes the question of correcting the typewritten errors, of which there are bound to be a number. At last the report will find its way to the proper quarters, but by that time the foreman will have been tired of waiting and managed to get rid of the trouble in some way of his own, possibly by talking nicely to the inspection department. I hope that readers will not think that I am trying to paint a ludicrous picture—actually, this is more in the nature of a photograph.

With regard to shop difficulties, I have always found that it is by far the better way to do as little writing as possible, and get the help of the foreman. If once the system of writing reports on details comes into vogue, there will be a deluge of shop complaints. If a new job comes along and there is a delay in delivery, some fault with the tools or fixtures will be bound to occur, and the onus of the delay will rest upon the planning or investigation department. Besides, most of the facts embodied in a report of necessity come from the shops, and foremen have a rooted objection to seeing their own remarks on paper with another person's signature at the bottom.

The great thing is to strike the mean and write neither too much nor too little. One of the best ways out of it is to make all shop reports and investigations as informal as possible. Call a miller a miller and not a milling machine. Avoid typewriting and use handwritten notes. If necessary, these may have a duplicate carbon copy. It is surprising what a lot of difference the elimination of typewriting does.

C. B. Gordon-Sale

Devices for Thread Measurements



Methods and Equipment for Accurate Gaging of Tap Threads

By A. L. VALENTINE, Manager, Tap and Gage Division, S K F Industries, Gothenburg, Sweden

PREVIOUS installments of this series of articles have discussed the design and construction of different types of taps, with special reference to taps having ground threads. The last installment dealt with methods and devices used for accurately measuring tap threads. This subject will be continued in the present article, which deals with gages for resharpened taps, measuring instruments for taps with three and five flutes, and devices for measuring the dimensions of taper taps.

Gages for Resharpened Taps

One aspect that has not been touched upon in this series of articles is the measuring of taps after they have been resharpened. Probably the best system for this purpose is that known as the Wickman, which employs "Go" and "Not Go" gages; this is also very suitable for measuring and checking new, unused taps. Two gages are required, each having two pairs of anvils, as shown in Fig. 2. At *A* is shown the gage used for determining that no part of the tap is too large on any dimension over the entire length of engagement; at *B* is shown the "Not Go" full diameter set of anvils; at *C* is shown the "Not Go" root diameter anvils; and at *D*, the "Not Go" pitch diameter anvils. Any tap that passes the tests imposed by these four gages is correct in all its essential thread elements.

Device for Measuring Odd-fluted Tools

Several instruments for measuring odd-fluted tools have been illustrated and described from time to time in the technical press. Most of these have been bench or inspection instruments, not always suitable for measuring work in process of manufacture or mounted in a machine. Often, however, it is necessary to measure the work while so mounted, and for this purpose the device shown in Fig. 1 has been designed. This device has proved to be a great labor-saver, and it is quite simple and

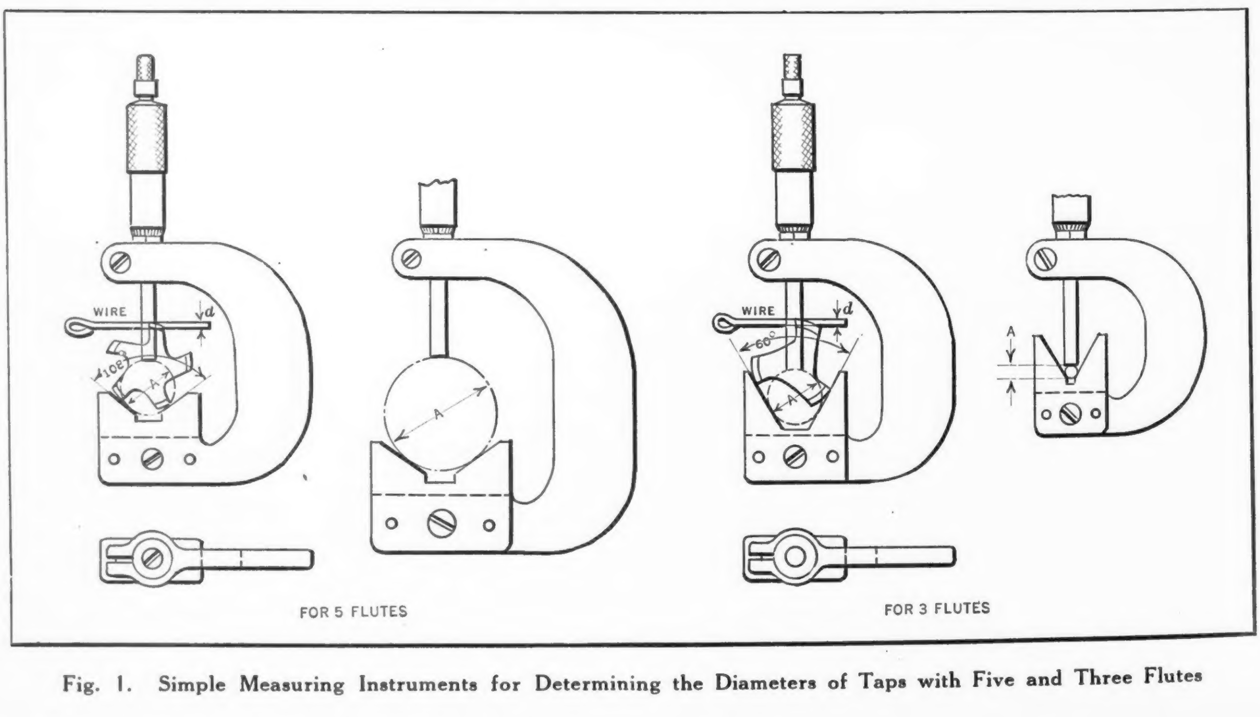


Fig. 1. Simple Measuring Instruments for Determining the Diameters of Taps with Five and Three Flutes

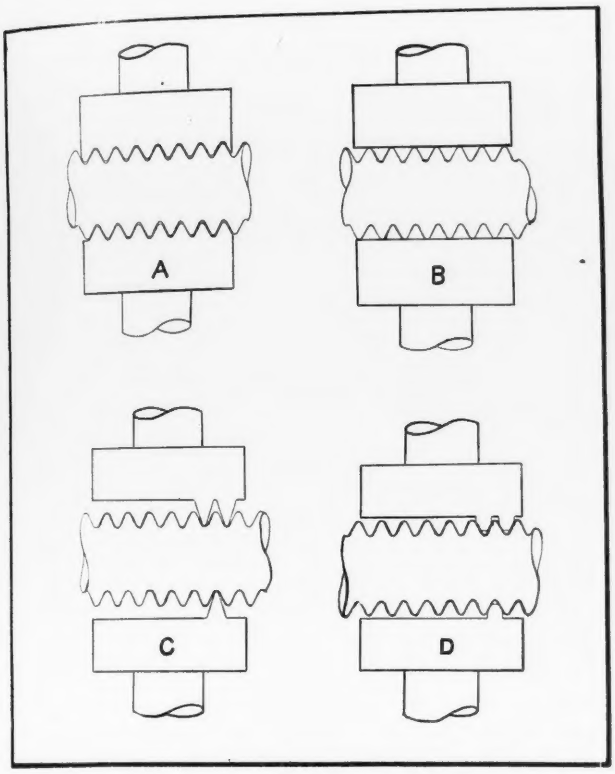


Fig. 2. Gages for Rapidly Inspecting the Accuracy of Threads

cheap to manufacture. Standard micrometer heads can be used. The anvils should be hardened and ground. The device is calibrated by the use of plug gages, as indicated.

In order to save time in measuring, the scope or range of each instrument can be reduced, and by so doing, less time will be consumed in screwing the micrometer in and out in order to remove the instrument from the work being measured. In such cases, more instruments will be necessary for the same range of sizes, but in quantity production this will more than pay for itself. As indicated, the device can be used for measuring the pitch diameter by means of a wire, one wire only being used. As five-fluted taps are becoming more and more common, it is of considerable advantage to be able to measure taps that have this number of flutes.

Formulas are given in the following for the use of the instrument shown in Fig. 1. In these formulas,

D_o = outside diameter;
D_p = pitch diameter;
A = diameter of calibrating gage;
P = pitch;
d = diameter of wire;
M = micrometer reading, for outside diameter; and
M_1 = micrometer reading, for pitch diameter.

For taps with five flutes, Whitworth form of thread, the following formulas apply:

Maximum diameter of wire $= 0.84P$; minimum diameter of wire $= 0.51P$

$$D_o = 0.8944 \times M + A$$

$$D_p = 0.8944 \times M_1 + A + (0.0756P - 1.4157d)$$

These formulas may be transposed as follows:

Micrometer reading for outside diameter $= (D_o - A) \times 1.11805$

Micrometer reading for pitch diameter $= (1.5829d - 0.8004P)$ + micrometer reading for outside diameter

For the United States and the International System form of threads:

Maximum diameter of wire $= 1.01P$; minimum diameter of wire $= 0.51P$.

$$D_o = 0.8944 \times M + A$$

$$D_p = 0.8944 \times M_1 + A + (0.0282P - 1.3416d)$$

Micrometer reading for outside diameter $= (D_o - A) \times 1.11805$

Micrometer reading for pitch diameter $= (1.5d - 0.7578P)$ + micrometer reading for outside diameter

Formulas for Three-fluted Taps

For Whitworth form of thread:

$$D_o = 2/3 \times M + A$$

$$D_p = 2/3 \times M_1 + A - (0.1067P + 1.0553d)$$

Micrometer reading for outside diameter $= (D_o - A) \times 1.5$

Micrometer reading for pitch diameter $= (1.5829d - 0.8004P)$ + micrometer reading for outside diameter

For the United States and International System form of thread:

$$D_o = 2/3 \times M + A$$

$$D_p = 2/3 \times M_1 + A - (0.1443P + d)$$

Micrometer reading for outside diameter $= (D_o - A) \times 1.5$

Fig. 3. Bench Micrometers for Taps with Five and Three Flutes—A, Horizontal Type, for Short Taps; B, Vertical Type, for Long Taps

· Micrometer reading for pitch diameter = (1.5*d* — 0.7578*P*) + micrometer reading for outside diameter

It should be noted that the maximum and minimum diameters of wire specified are recommended for practical use, and are not the theoretical maximum and minimum diameters.

Bench instruments especially suitable for the inspection of taps with three and five flutes are shown in Fig. 3. It is evident that these can be operated more quickly than the hand instruments shown in Fig. 1.

Errors in Measuring Pitch Diameters with Wires

In measuring pitch diameter with wires, an approximation only is obtained, because the wires are assumed to be at right angles to the axial center line of the tap, which they are not. This approximation is of no importance in practice for taps with standard threads, where the measuring error seldom exceeds 0.0002 inch. The error is, however, of importance when more than ordinary accuracy is required, as, for example, when measuring thread gages, or when the lead of the thread is great in relation to the diameter of the tap, which is usually the case in taps with Acme threads. The error is still greater when the taps have double, triple, or quadruple threads.

Measuring Taper Threaded Taps

The measuring of taper taps presents a problem of more than ordinary difficulty. Fig. 4 shows a device by means of which the outside and pitch diameters of taper taps can be measured quickly and accurately, the measurements being independent of each other. The device has two centers between which are mounted first the plug gages, and then the taps to be measured. At an angle to the centers, but at the same height, are mounted two micrometer heads, by means of which not only the diameter, but also the taper, can be measured with setting plugs. The outside diameter is read off directly on the micrometers, and when the pitch diameter is measured, a wire of suitable diameter is employed.

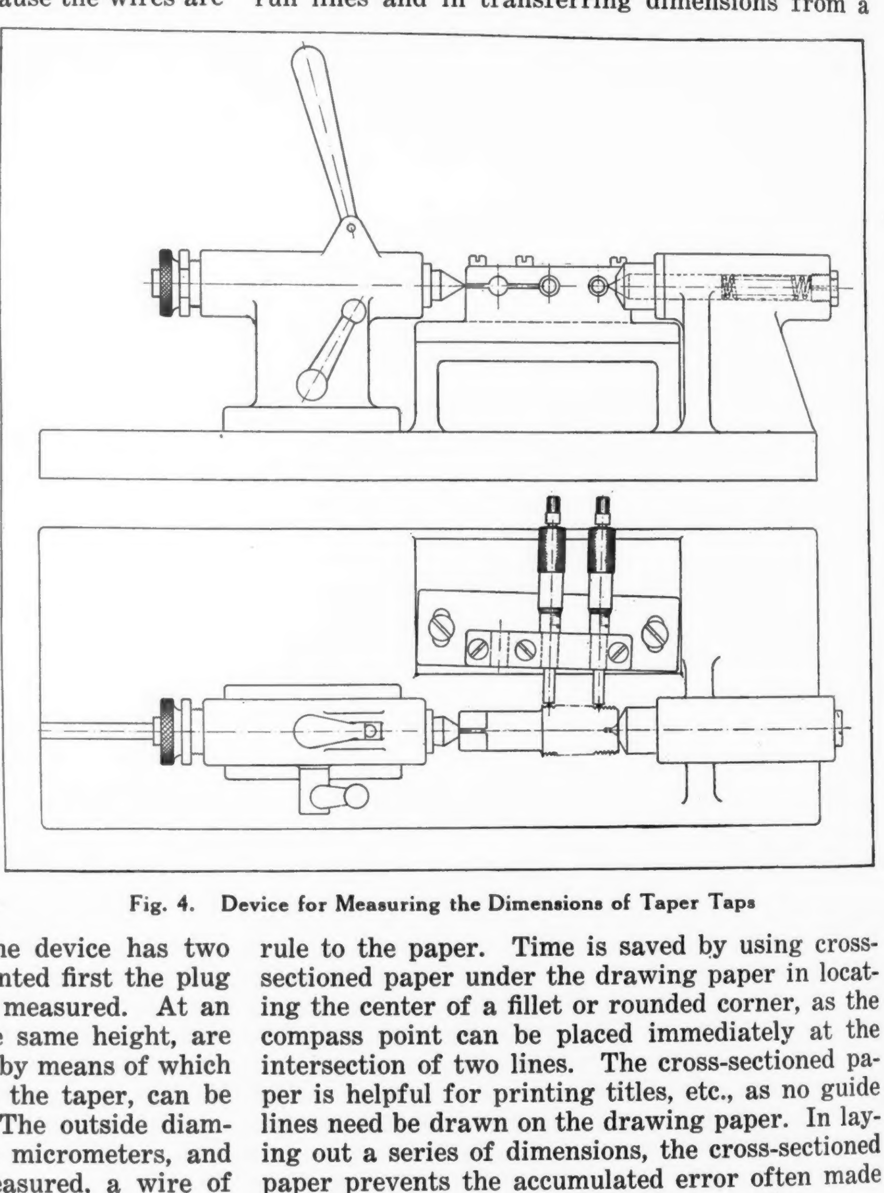


Fig. 4. Device for Measuring the Dimensions of Taper Taps

* * *

A drill stated to be the smallest twist drill in the world was shown at the Detroit exposition in September by the National Twist Drill & Tool Co. of Detroit, Mich. The drill was 0.005 inch in diameter, and made in the same way as ordinary wire-drill sizes of twist drills. It has actually been used for drilling holes. The smallest size of twist drill usually made is No. 80, which is 0.0135 inch in diameter.

SPEED AND ACCURACY IN DETAILING

By J. S. BEGGS

If details are drawn on paper such as is used for making blueprints directly from pencil drawings, greater speed and accuracy can be obtained by covering the drawing-board with square cross-sectioned paper, which can be secured from any drawing material supply company. The inch spaced lines on this paper are heavy, while the half-inch are medium, and the one-eighth inch fine. A line may be drawn to any desired length by counting the inch squares or their subdivisions on the cross-sectioned paper.

This method eliminates time lost in erasing over-run lines and in transferring dimensions from a rule to the paper. Time is saved by using cross-sectioned paper under the drawing paper in locating the center of a fillet or rounded corner, as the compass point can be placed immediately at the intersection of two lines. The cross-sectioned paper is helpful for printing titles, etc., as no guide lines need be drawn on the drawing paper. In laying out a series of dimensions, the cross-sectioned paper prevents the accumulated error often made in laying out a series of component lengths.

* * *

The service rendered by present-day automotive equipment is indicated by statistics collected by the White Motor Co. recording the mileage made by trucks of the company's manufacture. Investigation has shown that 117 trucks and buses have run 500,000 miles each, while 11,256 have run over 100,000 miles each. Only a few years ago such high mileage would have been considered very unusual, if not impossible.

Machining Yokes on a Broaching Machine

By GEORGE E. HODGES

THE high-speed broaching machine has opened up a broad new field for machining work by the broaching process. The broaching tools and fixtures required are simple in design and their first cost is low. The broaches may be resharpened from time to time at a reasonable cost. While designed to have a large number of teeth, the broach requires a small amount of grinding per tooth, as the cutting edge of each tooth is not in constant contact with the work.

In Fig. 1 is shown a universal joint yoke on which four parallel surfaces are to be machined, as indicated by the finish marks. The essential dimensions are represented by *A* and *B*. The broaching fixture on which the work is mounted is shown in Fig. 2. It consists of an arbor of the hinged leaf style, which has a shoulder for holding the yoke down against the thrust developed by the cutting action of the broach.

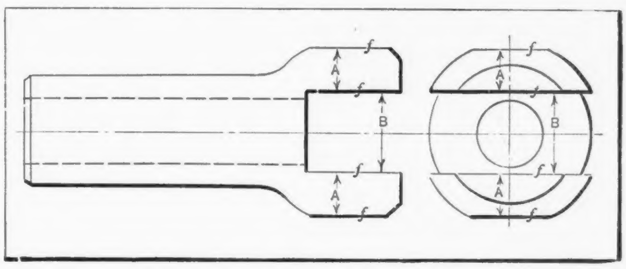


Fig. 1. Universal Joint Yoke

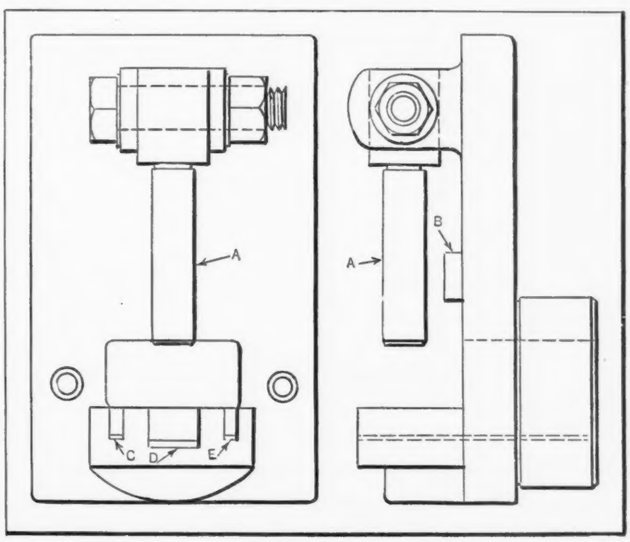


Fig. 2. Fixture for Holding Part Shown in Fig. 1 While Broaching the Finished Surfaces

The work is slipped on the arbor *A*, and then swung down over the pilot section of the broach shown in Fig. 3. When the cut is started, the yoke is centered by the pilot. At the completion of the cut, the arbor is swung up out of the way, so that the work can be removed and a new piece put on the arbor while the draw-rod is on the return stroke. With this arrangement, one yoke is completed at each stroke of the machine. This gives a production of several hundred pieces a day, depending on the speed at which the machine is operated. The floor-to-floor time in most cases is less than one minute per piece.

The body of the fixture is an iron casting machined with the usual boss, which fits the hole in the faceplate of the broaching machine. Two lugs support the swivel bolt, and there is a bracket for supporting the ways. The leaf-type arbor is made of square machine steel, the end being turned and ground to fit the hole in the work. There is a slight clearance, of not more than 0.002 inch, between the arbor and the low limit of the hole bored in the yoke. A stop *B* is also provided to keep the work approximately in a vertical position during the cutting stroke. The fixture may be drilled and countersunk for the flat-head screws generally used to hold the bushings in the machine.

The ways of the fixture are milled to suit the broaches and the dimensions *A* and *B*, Fig. 1. They are milled out of machine steel, and may be ground if the demand for accuracy warrants this method of finishing. Hardened steel shims *C*, *D*, and *E*, Fig. 2, are provided at the bottom of the ways. These shims are held in place by flat-head screws which pass through the block into the bracket.

The center broach, shown in Fig. 3, has a soft steel body with cutter blades of high-speed steel. These blades are held in place by screws, and have teeth cut on one edge. The cut per tooth is light, and the spacing of the teeth is much finer than is usual in broaches. The reason for the light cut is that the broaches cut only on the corners, removing merely the flash, the outer section of the forging, and such stock as is necessary to bring the work to size.

A common formula for obtaining the pitch of the teeth is $p = l \div 8$, l being the length of the work to be cut. With the pitch determined by this formula, a cut of 0.030 to 0.035 inch can be safely taken per tooth. The tooth has a front rake of 10 degrees and a top clearance of 2 degrees. A good tooth can be cut with a 60-degree cutter, leaving the land at the top of the tooth equal to about one-fourth the pitch.

By attaching blades as shown, the initial cost of the tools is kept down and the broach is actually made stronger, owing to the fact that the soft steel body is tougher than the solid high-speed steel broach after it has been hardened. The body is of rectangular cross-section and has shoulders planed on the sides to receive the cutters. The shoulders for these cutters are machined at an angle with the back of the broach to provide the required taper. The pilot has an inverted V-section which centers the work, and the shank is slotted to receive the pulling key. The holes for the screws are staggered on opposite sides to give maximum strength.

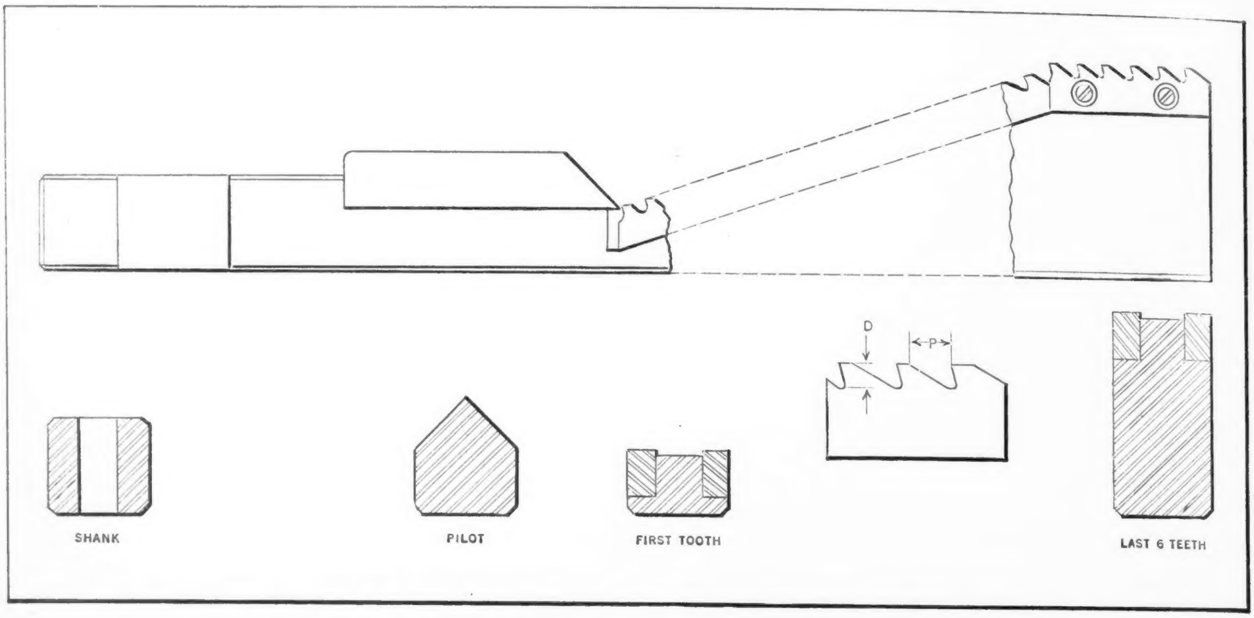


Fig. 3. **Broach for Finishing Work to Dimension B, Fig. 1**

The side broaches, one of which is shown at *A*, Fig. 4, are of high-speed steel with teeth cut on the tapered side. They present the same rake and clearance angles to the work as the center broach and are interchangeable. These side broaches are made the same length as the center broach, because if they were made shorter, they would be pulled entirely through the fixture so that they would drop down out of place before the longer center broach had completed its stroke. By making these broaches longer, however, the cut per tooth is less.

It will be evident from the view of the holder shown in Fig. 2 that the side broaches will be rather slender in some cases. They may be made any convenient thickness, the limiting factor being the size of the hole in the faceplate of the machine. Of course, this hole may be enlarged in some cases, but that would also necessitate the use of a bushing having a hole the same size as the original hole in the faceplate in order to permit the regular work bushings and guides to be used with the machine. The enlarged hole should be counterbored to allow the bushing to be flush with the faceplate. The boss on the fixture should be made the same size as the enlarged hole.

At *B*, Fig. 4, is shown a side broach which is to be preferred to the one shown at *A*, if the latter type cannot be made sufficiently thick to resist the tendency to crowd away from the work. The type of broach shown at *B* requires ways on the side of the fixture instead of at the bottom. The cut is taken all the way across the top of the broach, instead of at the corners. In width, the broach is equal to the greatest length of the work it has to cut, and it is made any convenient thickness. The teeth may be cut with the same pitch and tooth form as the center broach. They are cut at an angle to give a shearing cut. One broach is made

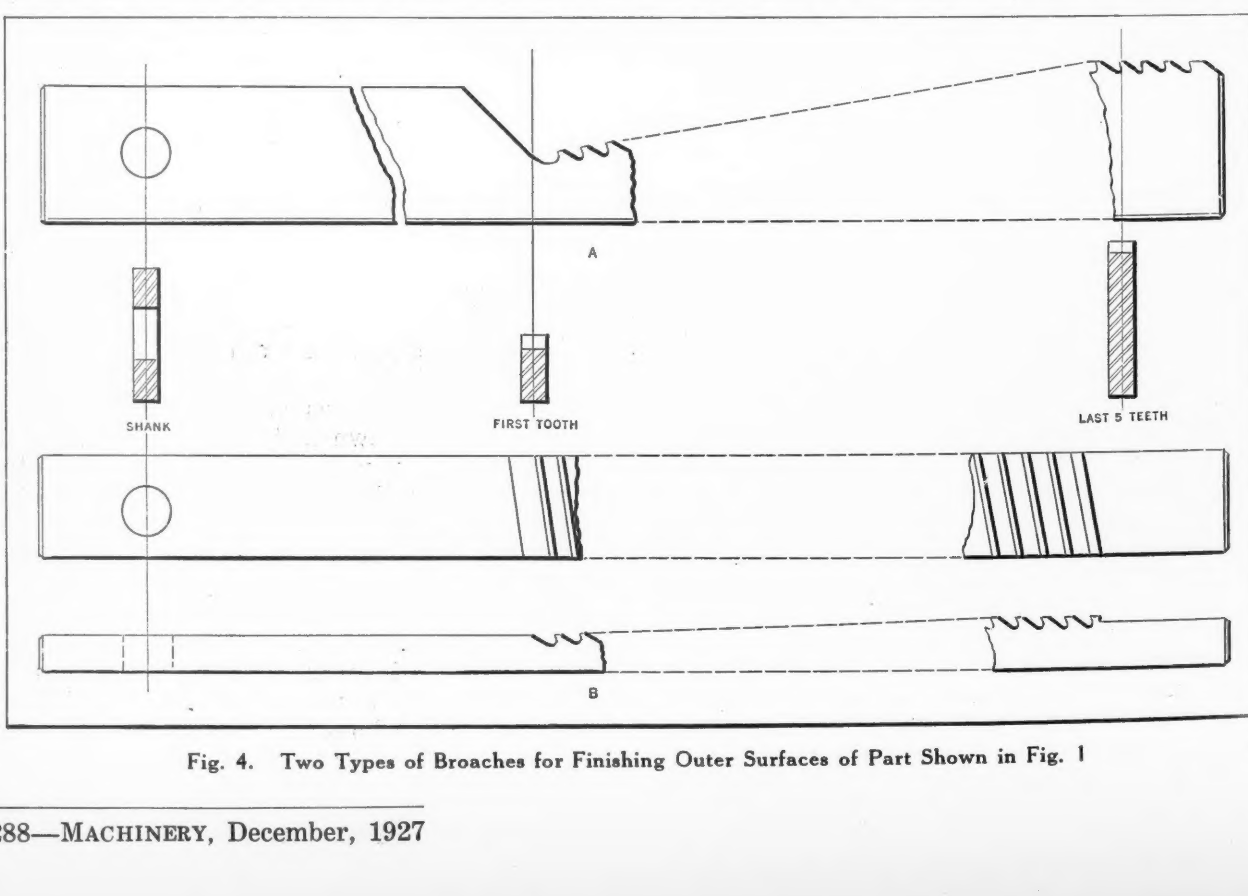


Fig. 4. **Two Types of Broaches for Finishing Outer Surfaces of Part Shown in Fig. 1**

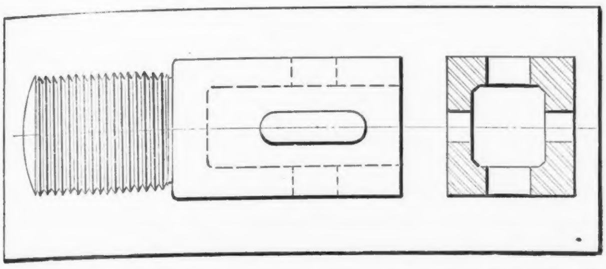


Fig. 5. Pull-bushing for Broaches Used in Finishing Yoke

with a right-hand lead and the other with a left-hand lead. These broaches will not be interchangeable, as in the case of broaches like the one shown at *A*, Fig. 4, which cuts on the corners only.

In Fig. 5 is shown the pull-bushing used in conjunction with these broaches. It is threaded to fit the vertical head of the broaching machine. The square hole in the center receives the shank of the center broach, and the bushing is slotted for the pulling key. The side broaches are held in place by pins or screws, and the bushing is drilled to receive them. There should be some clearance in the square hole to allow the broach to "work" during the cutting operation. The necessary clearance is provided for the side broaches by making the holes for the pins in the broaches slightly larger than the pins. It will be noticed that specific dimensions have been avoided, the object being to demonstrate the machining principle rather than the application to a specific piece. The broaches are similar, in a way, to a multiple planing tool, each tooth taking a small part of the whole cut, and the taper of the broach serving to provide the feed. This method of machining small lots of a few thousand pieces can be used for a number of similar jobs. It is particularly well adapted for machining yoke forgings for such assemblies as universal and knuckle joints.

* * *

THE CENTER OF INDUSTRY

In January, 1908, the center of industry in the United States was located on the northern boundry of Indiana, about 110 miles east of Chicago. In January, 1918, it was still on the northern boundry of Indiana, but had moved about 50 miles nearer Chicago. In January, 1926, it was 25 miles southwest of its position in 1918, and about 50 miles southeast of Chicago. The total movement from 1908 to 1926 was 75 miles in a southwesterly direction.

These determinations of the center of industry, which have been made by the Geological Survey, are based on the capacity of steam engines, steam turbines, water wheels, and internal combustion engines in manufacturing and in public-utility power plants.

The geographic center of the United States is near the center of the northern boundry of Kansas, and the center of population is in Owen County, southwestern Indiana. The center of industry of the United States in 1926 was, therefore, 640 miles northeast of the geographic center and about 170 miles north of the center of population.

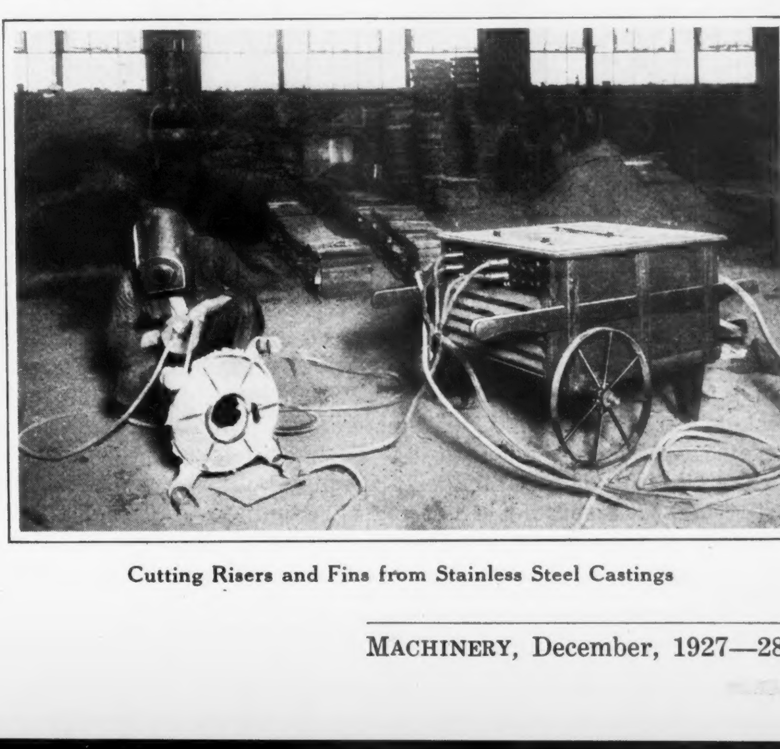
CUTTING STAINLESS STEEL CASTINGS WITH THE ELECTRIC ARC

By C. J. HOLSLAG, Chief Engineer, Electric Arc Cutting & Welding Co., Newark, N. J.

Quite a good deal has been written about the welding of stainless steel. Each particular alloy and application of this new rustless metal presents a distinct welding problem. Some alloys are best welded with gas, some with direct-current and some with alternating-current electric welding equipment. Of the two electric welding methods, that using direct current is generally preferable for the copper-base rustless alloys, while that employing alternating current is better for the chromium and nickel-base alloys. It is the object of this article to deal with the problem of cutting off the gates, risers, fringe, and overflow on castings that are produced from this new line of rustless alloys.

Several firms have found that it would hardly pay to make castings from these alloys if it were necessary to use ordinary methods of cutting. By drilling or sawing or cutting with a high-speed wheel, the cost of getting the casting into machineable shape is prohibitive. Stainless steel alloy castings are tough and hard and wear out good tools more rapidly than any of the commonly used metals, with the possible exception of chilled cast iron. By the use of the arc process which has been developed by the firm with which the writer is identified, the gates, risers, fringe and overflow of these castings can be cut off very quickly, with minimum power requirements and without changing the temper or quality of the casting. By this process, the cuts can also be kept smooth and ready for machining, so that very little grinding is necessary.

The type of installation used for this work is shown in the foreground of the accompanying illustration. In the background may be seen the electric furnace from which castings are poured. Thus, it is seen that electric power is readily obtainable from practically every point where such castings are made. The cutting equipment is also adapted for welding, and is made in three sizes according to the maximum thickness of the gates to be cut.



Cutting Risers and Fins from Stainless Steel Castings

DO YOU HAVE TROUBLE WITH CUTTING-OFF TOOLS?

By H. L. WHEELER

Cutting-off or parting tools give lathe operators more trouble, perhaps, than any other tool. This is particularly true when large round steel bar stock is being machined. Often the first sign of trouble is a slight chattering of the tool, which gradually becomes more pronounced as the depth of cut is increased. Then suddenly the tool breaks with a crashing sound like glass breaking. To make matters worse, it often happens that the tool broken is the only one in the shop adapted for the work, and it may be several hours before another can be obtained.

Many machinists approach the task of cutting off large bars with fear that the tool will break before the job is finished. To overcome such difficulty with parting tools, it is essential to understand the cause of the trouble. Fear of impending trouble and nervousness or timidity should be eliminated, as such states of mind have a considerable influence on the success or failure of any undertaking.

Make Sure the Machine and the Tool are Properly Adjusted

Every machinist knows that the spindle bearings and cross-slide of a lathe must be well fitted in order to do good work. This applies particularly to the use of cutting-off tools. In some cases, the lathe may be too light for the job, but this, of course, cannot be helped, unless a heavier lathe is available. When the lathe is too light, it is particularly important that attention be given to the adjustments of the machine and to the details of the cutting tool.

There are several important points regarding the action of cutting-off tools that must be carefully observed in order to obtain the best results. Among other things, the side clearance and the front rake angle must be right. The tool should be rigidly supported and overhang the toolpost as little as possible. The piece to be cut off should be rigidly chucked, and the cut taken as close to the chuck as possible. When the distance from the chuck is too great to permit the tool to operate without chatter, a steadyrest should be employed to support the work.

Stop and Investigate When Chatter Develops

When a tool begins to chatter, it usually is an indication that something is loose or is giving way under the pressure of the cut. This is a warning that should not be overlooked. Examine the spindle bearing to see if it permits the spindle to rise under the pressure of the cut. Also, examine the spindle bearing for end play. The cross-slide gib may be loose or badly worn and in need of adjustment. Make sure that the tool is tight in the toolpost and does not project too far. When the tailstock center is used to support one end of the work, it may have been extended too far beyond the supporting bearing of the tailstock or it may be loose. If the tailstock spindle is not rigidly clamped, it will allow the work to rise and push the tool downward.

If these precautions are not taken, the tool is likely to break without a second's warning. Sometimes the work begins to smoke or climb, the back-gears emit groans, or the belt shrieks as a warning of the final crash when the tool breaks. It should be remembered that the parting tool is confined by the walls of the cut so that the heat generated cannot escape so readily as it does in the case of turning or facing tools; consequently, the point of the tool is burned and quickly dulled, so that it will not cut freely. Under these conditions, the chips become wedged in the slot, with the result described.

Method of Grinding Cutting-off Tools

It is obvious that a cutting-off tool should have some clearance on the sides, yet there are workmen who try to use a tool having no clearance, or worse, one that is narrow on the point. The side clearance should not be too great, however, as it will weaken the blade and may cause scoring of the side walls where the fine chips become lodged in the clearance space. From 1/2 to 1 degree clearance should be sufficient for the sides of a parting tool. The tool should be carefully set so that the clearance is equal on both sides. A rake angle of 3 degrees should seldom be exceeded, as a larger angle will weaken the cutting edge. For most work, the face of the cutting-off tool can be set on or slightly above the center line of the spindle.

In the shop where the writer served his apprenticeship, he was required to use cutting-off tools having blades from 1/16 to 3/4 inch in thickness. Many of these tools were broken until a friend explained a few kinks regarding their use, which proved effective.

One of these kinks, which the writer has used for more than twenty years, concerns the grinding of the tool point. Instead of grinding the point of the tool to a square end, it is rounded to a radius of about 1 inch. The cutting-off tool, with a point formed to a radius in this manner, will produce a chip having a convex cross-section. A chip of this shape will be narrower than the width of the cut, will prevent the chips from binding or clogging up the slot, and will allow them to pass out freely.

Should Back-gears Be Used?

An important point to be considered is the amount of power required in cutting off work. Many machinists seem to think that back-gears are always required for cutting-off operations, regardless of the size or diameter of the work. This is a policy that is unwarranted. The use of back-gears for cutting-off operations on small work is not only a waste of time, but results in the loss of the margin of safety offered by a slipping belt. Unless the diameter of the work is so large that the lowest speed obtainable with an open belt is too great, the use of back-gears for cutting-off operations should be avoided.

For large work requiring deep cuts, it will be found advantageous to take one-half the cut and then increase the width of the slot by taking side cuts, so that there will be more room for the chips to clear the cut. Oil or some good cooling compound should be used for all metals except cast iron. Considerable heat is generated by a cutting-

off tool, and this cannot be carried away without the aid of a coolant. In order to cut freely, the corners of the tool must be kept sharp. It should be remembered that the corners of the tool will be quickly dulled if they become too hot.

Advantages of Inverted Cutting-off Tool

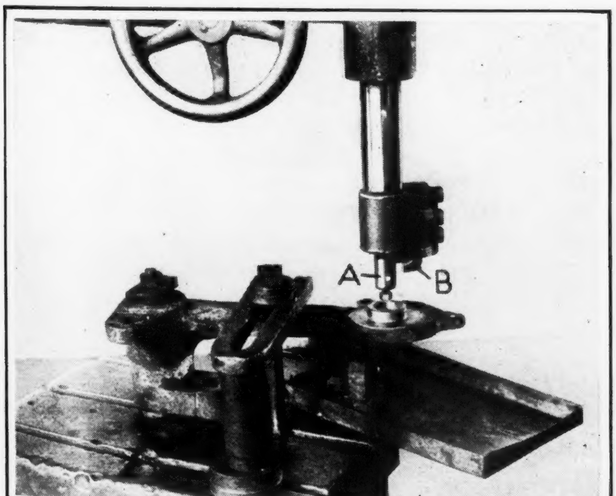
The ideal position for the cutting-off tool is on the back side of the work. It is possible to hold the cutting-off tool in an inverted position at the back of the work on many types of turret lathes and screw machines, but unfortunately, this cannot be done so readily on most engine lathes. When the tool is inverted, the chips fall away from the cut as soon as they are made, and seldom bind or clog up the cut. This method of holding the tool also has the advantage of exerting a downward instead of an upward pressure on the spindle, which eliminates the tendency of the work to lift or climb. Thus any vibration of the tool or work is more readily absorbed by the greater mass of metal directly under the spindle bearing.

* * *

TOOL FOR MACHINING BRAKE HANGER BOSSES

By J. R. PHELPS, San Bernardino Shops, Atchison, Topeka & Santa Fe Railway, San Bernardino, Cal.

Brake hanger bosses may be counterbored, faced, and turned in one operation by means of the tool shown in the accompanying illustration. This tool is intended for use in a drilling machine. A hole is first drilled through the boss with an ordinary twist drill. The combination tool illustrated then serves to counterbore the upper part of the drilled hole, face the top of the boss, and turn the outside. The boring is done by tool *A*, and the facing and turning by the double-edged



Combination Tool Used in Drill Press for Counterboring, Facing and Turning Outside of Brake Hanger Boss

tool *B*. The final operation is that of tapping that part of the hole which is below the counterbored section.

The time required for all these operations is sixteen minutes, whereas the old bonus schedule for the same work was one hour and twelve minutes, the latter time being based upon the use of a horizontal boring machine instead of a drill press.

RESIDUAL MAGNETISM AND ITS REMOVAL

By H. A. SEABRIGHT

Whenever magnetic chucks are used in handling steel products, a certain amount of residual magnetism results. The amount or strength depends upon the strength of magnetism applied and the quality and hardness of the steel. While a small amount of magnetism is not objectionable in some cases, it is quite troublesome in others. The tendency of small particles of steel to adhere to the product is

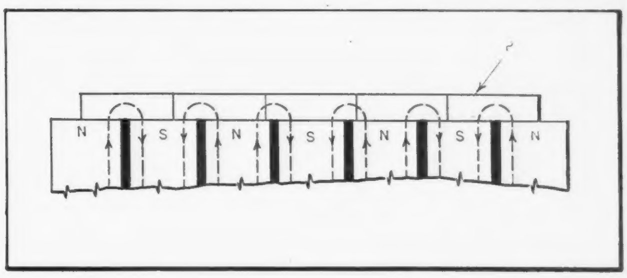


Fig. 1. Diagram Showing Lines of Magnetic Force in Chuck

a familiar source of trouble wherever magnetic chucks are used.

While the operation of magnetic chucks is fairly well understood by the average user, the problem of demagnetizing is usually not so clearly understood. As the use of magnetic chucks is becoming more universal, the operation of demagnetizing assumes greater importance. Especially is this true when large numbers of small steel parts are produced daily.

Action of Magnetic Chuck

Fig. 1 represents a section through the upper part of a magnetic chuck, where *N* and *S* are the north and south poles, respectively, of the magnets, and *P* the product being handled. The magnetic circuits are indicated by the dotted lines passing through the chuck and product. This condition is established by simply placing the product on the chuck face and closing the electric switch, thus supplying direct current to the chuck winding. In order to release the product, the switch is usually opened and thrown momentarily into the reverse position. The reversing current may be reduced by means of a suitable resistance, in which case the residual magnetism is lessened somewhat.

Removing Residual Magnetism

The action resulting from the reversal of the current can be represented diagrammatically as shown in Fig. 2, where the ordinates *HH* represent the energizing force applied to produce a given strength of magnetic field, as represented by abscissae *BB*. When current is applied, the magnetism builds up, as indicated by the graph *OA*. When it is turned off, the magnetism reduces, as indicated by *AC*, instead of returning to zero. The value of *OC* depends upon the strength of magnetism as represented by *HA* and the quality of the steel, the hardest steels retaining the most magnetism.

If the magnetizing current is reversed, the magnetic strength is reduced to zero, reverses, and builds up to an equal opposite value, as indicated by that part of the diagram which is below the horizontal line *HH*. If the reversed magne-

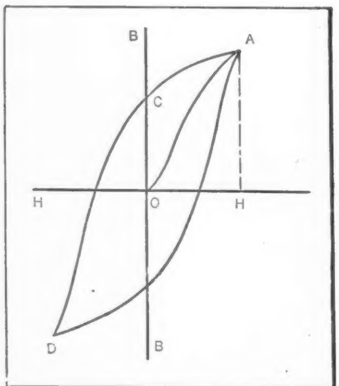


Fig. 2. Diagram Indicating Action of Reversing Current

tizing current is slightly less than the original current, the resulting magnetic strength will be reduced. Continued reversal and reduction of the magnetizing current will thus result in reducing the residual magnetism to zero. The same result will be obtained if the steel is gradually removed from the magnetic field while the magnetizing current is being reversed rapidly.

Fig. 3 represents a demagnetizing coil in which alternating current is used. The coil *C* is wound with insulated copper wire, the size and number of turns depending upon the voltage available and the strength of magnetism desired. The laminations *L* are built up around the coil to provide a suitable path for the magnetic circuit. The coil and laminations are mounted on a suitable table or support *S*. In demagnetizing steel products, it is necessary to simply pass them through the opening *O* or partly through, and then withdraw them while the current is applied to the terminals of the coil.

Construction of Demagnetizing Coil

The design of a demagnetizing coil depends upon the product being handled. In most cases, a plain coil with a rectangular opening will answer the purpose. The opening should be just large enough to receive the individual pieces, when handled singly, or a container when small pieces are handled. If a container is used, it should be of non-magnetic material. Laminated sheet transformer steel should be built up around the coil to give a magnetic circuit with the shortest possible air gap, arranged so the product will pass through this gap.

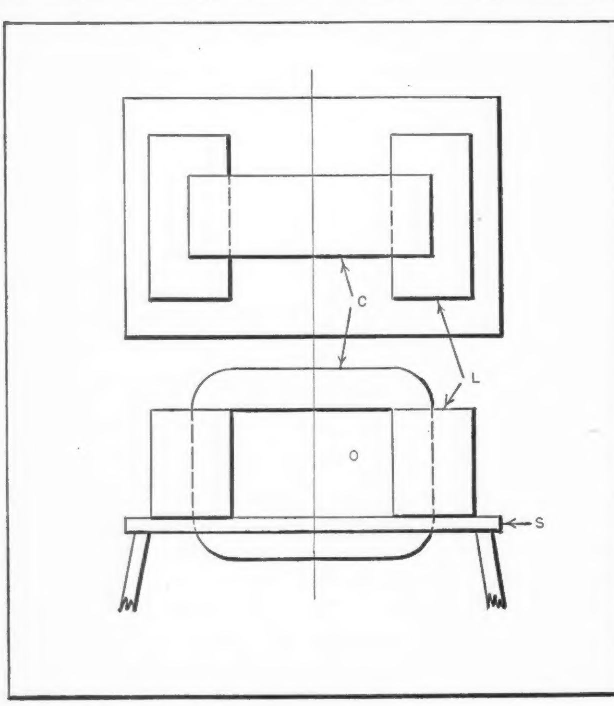


Fig. 3. Demagnetizing Coil

If the air gap is comparatively long, it will be difficult to obtain a strong magnetic field without using an excessive amount of current. This may be permissible if the current is applied for short intervals only, but when applied for longer intervals, the coil winding will become overheated and burn out. The coil may be wound in sections, so that the magnetic strength can be varied if necessary. The size of wire and the number of turns can usually be determined best by trial. A pilot light, conveniently located, is a useful signal to show when the current is on or off.

The possible arrangements and methods of using are quite varied, and range from large coils, where the product is carried through on conveyors, to small ones, where the individual pieces are demagnetized singly. In some cases, the current can be turned on and off automatically by the movement of the product in passing through the coil.

The economies effected by the demagnetizing equipment depend upon the quantity and nature of the product and the equipment in use. If a large number of small pieces are being demagnetized singly, it may be possible to do the work in one-tenth the time with suitable equipment. In other cases, the operation can be made entirely automatic, so that the operator's time can be utilized to better advantage.

* * *

DRILL JIG FOR SIX-CYLINDER CRANKCASE

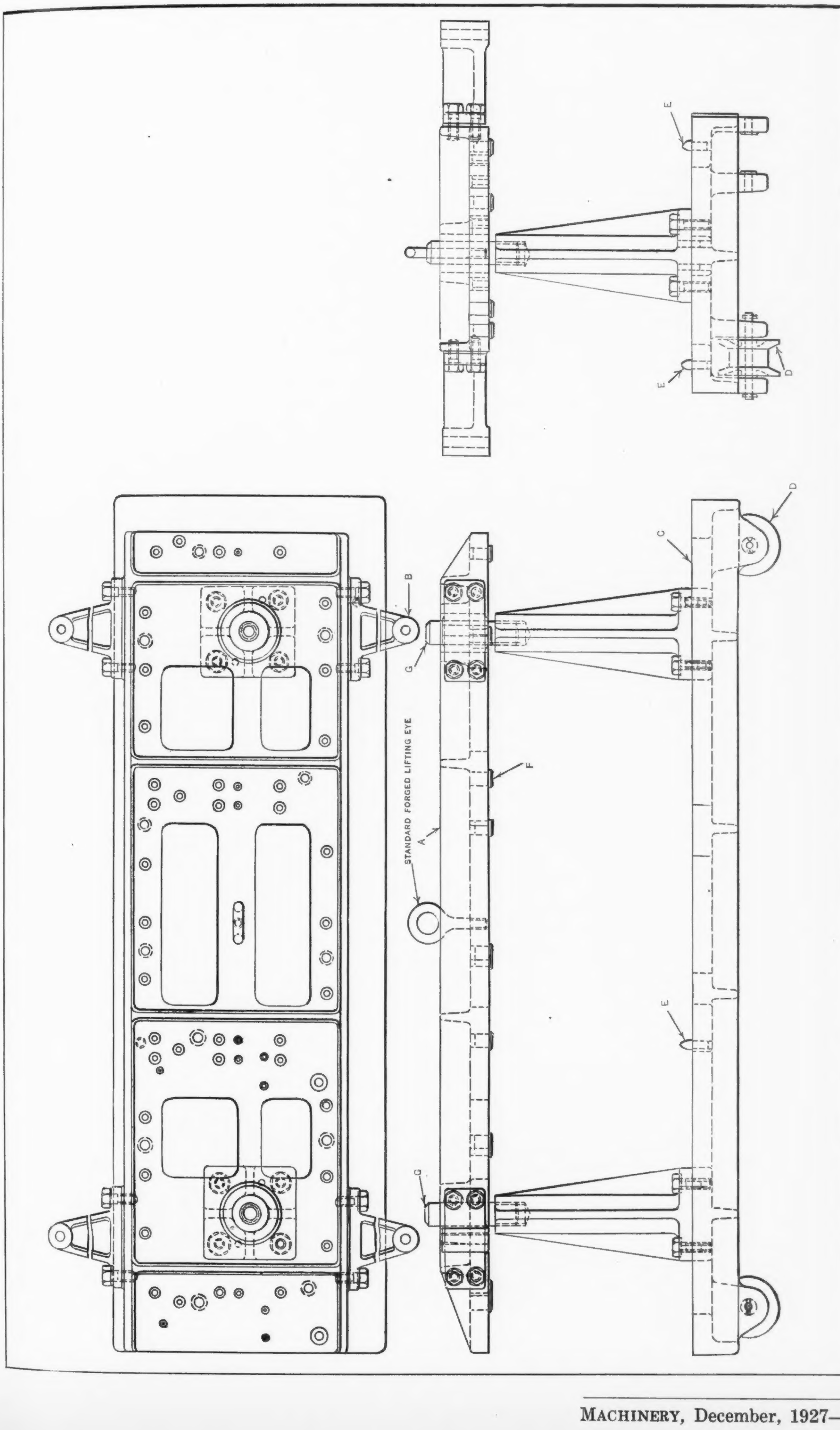
By EDWARD T. HEARD

In the accompanying illustration is shown a jig used in drilling practically all of the holes required in the top face of a six-cylinder crankcase for a marine engine. This jig is used on a multiple-spindle drilling machine. The drill plate *A*, which contains the hardened steel bushings that guide the drills, is securely fastened to the head of the drilling machine by means of the four brackets *B*. The lower member *C* of the jig is provided with four truck wheels *D*. These wheels run on a track which permits the jig to be rolled out from under the drilling plate to facilitate placing the work in position. The work is located on the jig by four pins *E* which fit reamed holes in the work.

After the work is in place, the jig is rolled under the drilling machine head. The drill plate *A* is then lowered until the hardened buttons *F* rest on the finished face of the crankcase. The jig is accurately lined up with the drill plate by the two guide pins *G*. After the work is drilled, the machine head is raised, permitting the jig to be rolled out from under the drill plate where the drilled crankcase can be easily removed and a new one clamped in place.

* * *

The first self-propelled highway vehicles were operated over English turnpikes more than eighty years ago, steam-driven vehicles being used. No further developments were made at that time along this line, however, because adverse legislation, possibly initiated by those interested in transportation by horse-drawn vehicles, required that a man with a red flag should proceed the vehicle to warn of its approach.



Jig Used in Drilling Crankcase of Six-cylinder Marine Engine

Effect of Temperature on Bored Holes

By FORREST E. CARDULLO, Chief Engineer, G. A. Gray Co., Cincinnati, Ohio

THE factor that creates the most difficulty in machining work and that is least understood by the average machinist is the effect of variations in temperature on the accuracy of the work. Let us suppose that the job in hand is boring and reaming a casting where a fairly close limit on the size is desired. The casting is set up in a turret lathe, and a single-point boring tool is used to bore out the interior, which requires a finish cut about 1/8 inch deep. We will also assume that the cut will be of uniform depth.

As the boring operation progresses, the casting becomes heated by the work of the cutting tool. When the bore is finished, the end of the casting next to the chuck is hotter than the outer end. After the finishing cut has been taken, which requires a relatively short time, and the reamer has been run through, the work will be of uniform diameter but of unequal temperature. When the piece is removed from the chuck and allowed to cool, it will be found that the hole is not cylindrical but slightly conical, being smaller at the end next to the chuck and also under-size throughout its whole length.

The average machinist, after thinking the matter over, would assume that since the reamer is much cooler than the work, even though the reamer cut to size, the bore would be smaller than the diameter of the reamer when the work cooled. It might not occur to him, however, that since there was a variation in temperature throughout the length of the work, the hole would not be truly cylindrical, but would be smaller in that part of the bore that was originally the hottest and that shrunk the most after machining.

Let us consider the case of a bushing which is to be bored, where considerably more metal must be removed from one side than from the other. In such a case, the side of the bushing from which the most metal is removed would become hotter than the other side. The internal surface or bore would also be hotter than the exterior surface. The result would be that the side having the higher temperature would elongate more than the other side, and because the outside of the bushing was cooler than the inside, the hole would tend to assume an oval shape.

After such a bushing was removed, it would be found that the hole was under-size and that it was smaller at the end that was bored last. Also the axis of the hole would not be straight, but would have a concave form on the side from which the most material had been removed. Further, the hole would not be round, the diameter being less in the plane of the bent axis than at right angles to this axis. If, in either of these cases, the bushing had been allowed to cool to the room temperature before taking the final finishing cut and performing the reaming operation, the errors referred to would have been avoided.

In the example cited, the bushing was assumed to be of uniform thickness. Assuming that the bushing is not of uniform thickness and that it is provided with flanges or ribs that may absorb or radiate heat, variations in the temperature of the work may occur that would cause it to be distorted. In such cases it is difficult to predict what the final form of the bushing will be after it is finished and while it still retains the heat generated by the roughing cut. In any event, if it is necessary that the work be accurate, it must be allowed to cool down to the temperature of the room before the final cut is taken. In the case of large pieces of work which must be planed straight, great care must be taken to guard against inaccuracies resulting from variations in temperature.

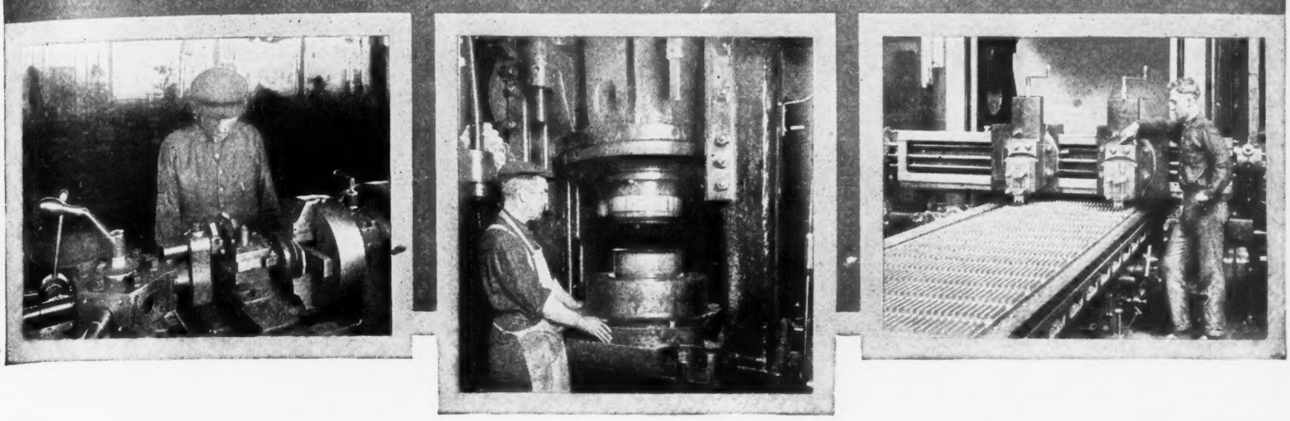
A few degrees difference in temperature between two sides of a long narrow piece, when the work is being fastened to the planer table results in one side being slightly longer than the other. This difference in length causes the piece to bow, and while the difference in length may be inappreciable, the effect in causing a long narrow piece to bow is considerable. Let us take, for example, a piece 6 inches wide and 10 feet long, with 10 degrees difference in temperature between the two sides. This will cause one side to be 0.0067 inch longer than the other side. This amount in 10 feet would scarcely be noticed, but if the work is planed while in this condition, when it is unclamped it will take the form of an arc with about 1/10 inch rise.

It will be noticed that in this series of articles, the machining defects described may be avoided by letting the work stand for some time between the roughing and finishing cuts. Consequently, seasoning has been accepted as a solution of many difficulties encountered in machine work. The writer is of the opinion that if, in machining, proper attention is paid to the elements of clamping, temperature, order of machine work, and other points that have been referred to in these articles, it will be unnecessary to season castings or forgings that have been properly annealed or allowed to cool slowly. In the majority of cases, seasoning is a waste of time, and in many cases where it is found to be necessary, it is an evidence of improper foundry practice.

* * *

In modern machine tool construction, the greatest problem is to design the work-holding means. The method of presenting the tools to the work, the automatic or semi-automatic movements required, and the drive of the machine present few new problems; but to hold the work firmly under the present-day heavy cuts and at the same time in such a manner that it can be easily clamped and unclamped is, perhaps, the most difficult problem encountered in the design of many modern machine tools.

Letters on Practical Subjects



IMPROVISED SET-UP FOR TURNING CRANKSHAFT

In the accompanying illustration, is shown diagrammatically a method of using standard shop equipment for turning or grinding a crankpin. The method was employed recently by the writer in repairing the crankshaft of a punch press. A 16-inch lathe with its four-jaw chuck *E* and the four-jaw chuck *F* of a 6-inch lathe were used for holding the work during the machining operation on the crankpin *B*. The only special equipment required in setting up the crankshaft was the adapter *A*. This adapter is machined and threaded the same as the headstock spindle of the lathe on which the 6-inch chuck was employed, except that the adapter is made solid. The plain part of the adapter is made a good fit in the chuck, and the flange has two flats machined on it to permit tightening with a wrench.

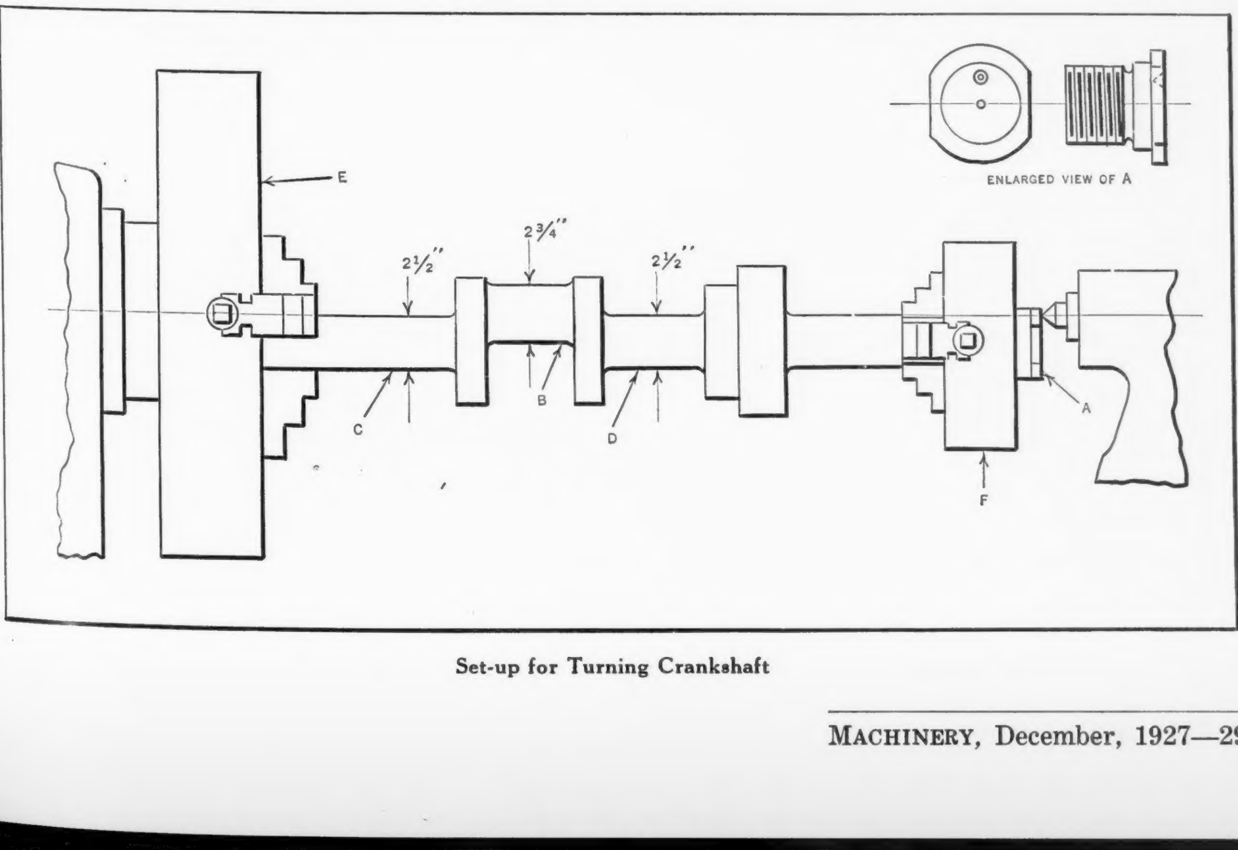
The center in the adapter block *A*, made to receive the point of the tailstock center, was located off center the amount necessary to permit turning the crankpin with the required throw of 1 1/4 inches. The chuck *F* was clamped to the shaft end with its adapter screwed tightly in place. Then the lathe chuck was set off center the required amount, and the other end of the crankshaft was gripped in the chuck of the lathe.

The pin *B* was trued up, using the two four-jaw chucks to bring it into alignment with the lathe spindle. The two bearings *C* and *D* were next leveled up and aligned with each other in each quarter-turn position, at the same time keeping the crankpin true. Two indicators were used in lining up the work. There are many ways in which a revolving chuck on a tailstock center, such as described in the foregoing, will be found useful, particularly in a repair shop.

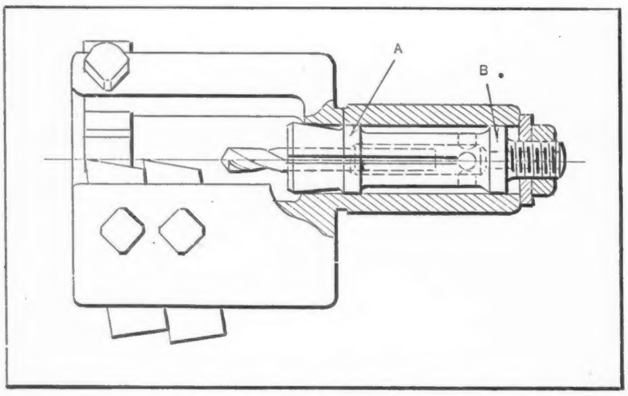
Long Beach, Cal. PERCY BROMLEY

TURRET TOOL-HOLDER PROVIDED WITH COLLET

No matter how many tool shank holes there are in the turret of a screw machine nor how many positions there are for tools in the holders, there will be occasions when there is just one too few tool-holding positions. Often the operation that causes the crowding of tools is of a minor nature, but it must, nevertheless, be carried out, although



Set-up for Turning Crankshaft



Box-tool with Collet

there is no adequate provision for holding the tool. This is particularly true of internal work, where there is room for only one tool to enter at a time, and in many cases, the nature of the work renders it impracticable to use a combination tool having several diameters.

The turret tool collet shown in the illustration was devised for use in box-tools and similar holders to meet conditions such as outlined. It is adapted for clamping small drills and internal cutters in holders of the box-tool type in which there is no room or no provision for holding such tools by means of a clamp screw. The construction of the collet is similar to that of the regular draw-in chucks used on lathes. The large portion is made with a taper of from 15 to 20 degrees included angle, which is less than that of the ordinary collet, because of the fact that the part must work against practically a sharp corner in the throat of the tool-holder shank instead of against a tapered surface. At equal distances from each end of the collet are two narrow shoulders. The shoulder *A* at the large end has a clearance of about 1/32 inch in the turret tool, and serves merely to stiffen the jaw, while the shoulder *B* at the rear end of the collet is a sliding fit, and serves to align the rear end of the collet.

The portion between the two shoulders on the collet is recessed, sufficient metal being removed to take some of the stiffness out of the jaws. A short threaded stem is machined on the rear end of the collet, which permits it to be drawn up by means of a nut acting against a washer on the end of the tool shank. The threaded stem is provided with a knock-out hole to facilitate removal or adjustment of the cutting tool.

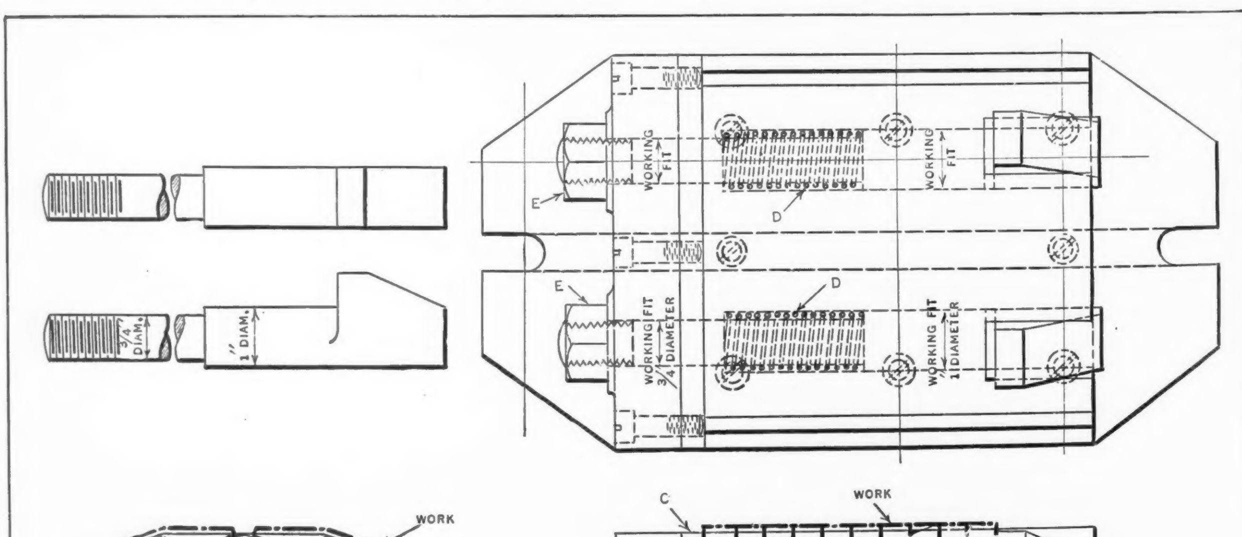
Although it is sometimes possible to adjust the tool with the holder clamped in the turret, the quickest and easiest way of setting the tool is to remove the holder from the turret. For this reason, it is best to use the collet only when the turret tool is not required to turn an outside dimension to close limits or when the tool in the collet is only required to take a light cut, thus permitting the cutting edge to stand up well.

Jena, Germany HENRY SIMON

MILLING BEVEL ON SMALL PIECES

In the accompanying illustration is shown a fixture employed in milling the bevel surfaces on toolmakers' clamps. This fixture holds twenty clamps at one setting, and has greatly increased production. It consists primarily of a cast-iron base *A*, a hardened and ground machine-steel body *B*, a front jaw *C* of hardened and ground machine steel, and two hook-bolts for clamping the work in place.

The body of the fixture is drilled and reamed to receive the two hook-bolts. Slots are cut at the ends of the reamed holes to allow the heads of the bolts to occupy the positions shown. The hook-bolts are provided with compression springs *D* to release them from contact with the work when the clamping nuts *E* are loosened. Fixtures designed along the lines of the one described give first-class



Fixture Employed in Milling the Bevel Surfaces on Toolmakers' Clamps

results, and can be adapted for a variety of small parts that require to be speedily and accurately machined.

Buffalo, N. Y. C. W. PUTNAM

INDEXING JIG FOR DRILLING HOLES AT DIFFERENT ANGLES

The indexing jig shown in Fig. 2 was employed for drilling, simultaneously, three holes in the flange and two holes at an angle of 30 degrees in the rib *Z* of the casting shown in Fig. 1. The drilling operation is performed on a multiple-spindle drilling machine. Previous to the development of the jig shown in Fig. 2, the three flange holes and the two angular holes were drilled in two separate operations. As the parts drilled were required in large quantities, it was deemed advisable to provide a jig that would permit a high production rate. The machining operations before drilling consisted of facing the flange and drilling the hole *Y* used in locating the work on the indexing jig.

As shown in Fig. 2, there is a cast column at the rear of base *A* that carries the shaft *J*. This shaft is a tight fit in the column, and is prevented from moving by the nut *K*. At the other end of shaft *J* is the indexing turret *B*, which turns freely on the shaft and is confined by the collar nut *M*. The lugs *E*, of which there are six, are slip fits in the recessed centers of the castings to be drilled. These lugs, together with the pin *C* that enters the small hole *Y* in the flange, serve to locate the work in the correct position on the turret. Clearance holes are provided in the turret to permit the drills to pass through the work.

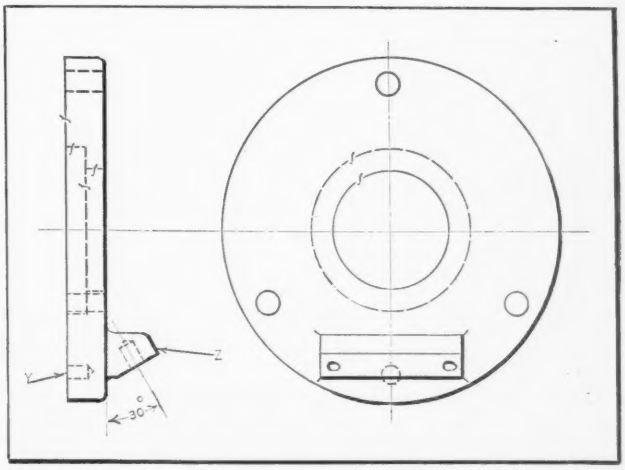


Fig. 1. Casting Drilled on Indexing Fixture Shown in Fig. 2

The turret is indexed by means of plunger *G* and the correctly spaced holes in the hardened and ground bushings *D*. The indexing plunger is backed up by the coil spring *H* in bracket *I*, which, in turn, is fastened to the base of the jig. The bushing plate *P* is secured to the vertical sliding member *O* on the column of the base. The two gibs *N* serve as retainers for slide *O*. The roll *S* is free to turn on the shoulder screw *T* which is screwed into the slide *O*. Roll *S* rests on the star-shaped cam *L* which is secured by screws and dowels to the rear side of turret *B*. For every one-sixth of a revolution of the turret, the bushing plate *P* is raised high enough by the cam to provide the necessary clearance for the work as it is indexed around to the next station.

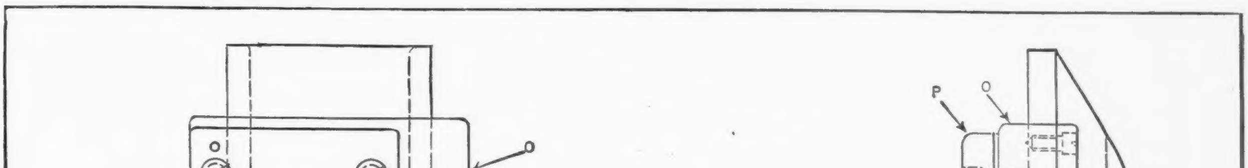


Fig. 2. Indexing Fixture Designed for Use on Multiple-spindle Drilling Machine

At the end of the indexing movement, the bushing plate again descends to its former position, as shown in Fig. 2, ready for drilling the flange of part U and the rib of part R. The operator places the work on the empty station at E, and after withdrawing the plunger G, indexes the turret around in a counter-clockwise direction until the plunger drops into the next indexing hole in the turret.

After being drilled, the work drops from the turret to a board placed on the drilling machine table, and is pushed clear of the jig by the operator. It was found that the drill carriage could be operated, and the turret indexed in six seconds, loading being done while the drills were cutting. By employing the jig described, production was increased approximately 50 per cent.

Bridgeport, Conn. J. E. FENNO

HOBBING BRASS WORM-GEARS

The writer recently visited two shops in which different methods of handling practically the same job are employed. Both shops made use of the machine that happened to be available for the work, which consisted of hobbing small brass worm-gears. Apparently one method gives as good results as the other. In one shop a milling machine is used, while in the other a drilling machine is employed. The number of pieces to be machined in either case is too small to make it advisable to buy a regular hobbing machine.

The hobbing fixture used on the milling machine is shown in Fig. 1. One of the worm-gears is shown in the hobbing position at A, and another finished piece on the table at B. The hob C is mounted on the milling machine arbor, which also carries a spur gear D meshing with another spur gear E. The latter gear is connected to the spindle that carries the hob, by means of a worm and worm-gear. The gear ratios are such that the worm-gear to be hobbed revolves at the correct rate for cutting the teeth; in other words, the speed of the shaft carrying the work is properly synchronized with the speed of the shaft on which the hob is mounted. The work is fed to the hob by pushing back on the lever F, which causes the blank worm-wheel or gear to swing up against the under side

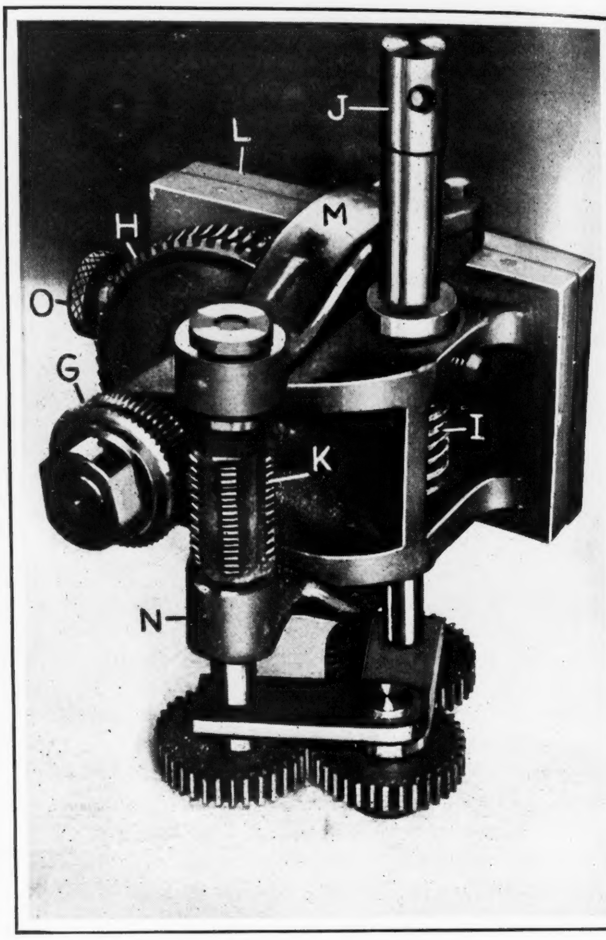


Fig. 2. Fixture for Hobbing Worm-gear on Drilling Machine

of the hobbing cutter. This is made possible by having the bracket that carries the hob spindle hinged to the shaft carrying the spur gear E.

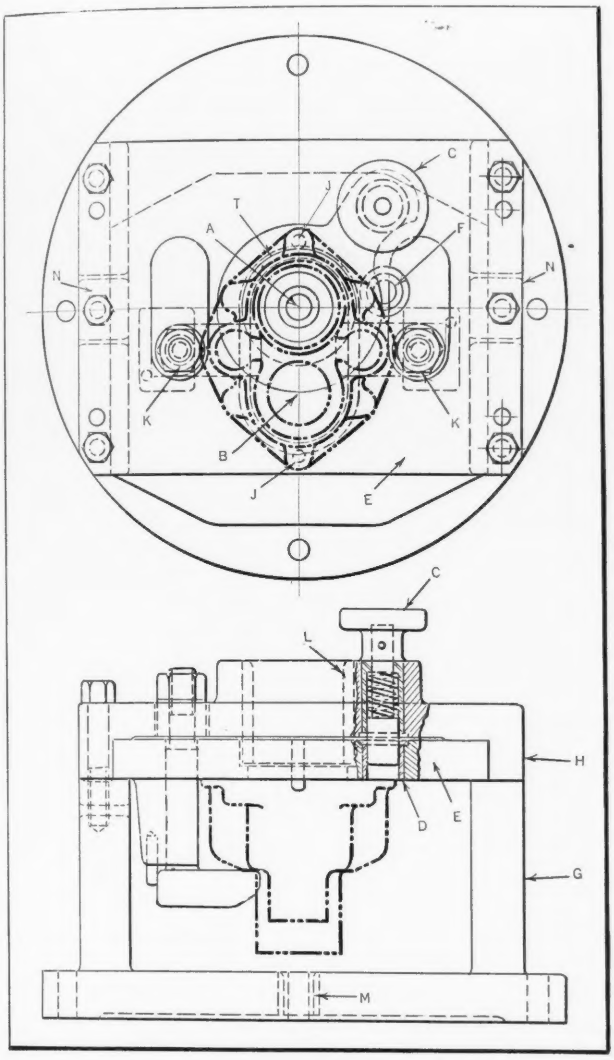
The drilling machine fixture is shown in Fig. 2. Here the worm-gear G to be hobbed is placed on the shaft with the worm-gear H which meshes with worm I on the driving shaft J. The driving shaft also carries a gear on its lower end, and is connected by two other gears to the shaft carrying the worm hob K. The hob shaft or spindle is secured to slide L by a bracket having two arms M and N. This construction permits the work to be fed to or from the hobbing cutter by simply turning the knurled knob O. A bracket at the back of the fixture, not visible in the illustration, keeps the three lower gears from coming in contact with the work-table, and holds the fixture rigid when the driving shaft is connected to the drilling machine spindle.

Cleveland, Ohio AVERY E. GRANVILLE

Fig. 1. Fixture Used on Milling Machine for Hobbing Worm-gear

BORING FIXTURE WITH TWO-POSITION WORK-HOLDER

The boring fixture shown in the accompanying illustration is designed for use in boring two holes in the body of a water pump. The fixture is secured to the faceplate of a turret lathe, and the body of the water pump to be bored is clamped in the fixture in the position shown by the heavy dot-and-dash lines. The centers A and B of the two holes to be bored are required to be exactly 2 inches apart. After boring the first hole at A, the clamps N are loosened and the plunger C is withdrawn



Boring Fixture for Gear Pump Body

from the hardened bushing *D* in the work-holding slide *E;* the slide is then moved over until the plunger drops into the hole in the hardened bushing *F*. This locates the work in the proper position for boring the hole *B*. The clamps *N* are, of course, tightened before starting the boring cut.

Referring to the construction of the fixture, it will be noted that the base *G* has a cover *H* secured in place by studs and dowel-pins. The cover *H* forms a slide bearing in which the work-holding plate *E* is fitted. Two hardened pins *J* are pressed into slide *E* in the proper positions for locating the work. The clamps are tightened on the work by means of the nuts *K*. The bushing *L*, which is pressed into the work plate, serves as a liner bushing for the slip bushing that guides the boring-bar. The bushing *M* in the base guides the pilot of the boring-bar.

Rochester, N. Y. EDWARD T. HEARD

TO FIND RADII AND NUMBER OF TEETH OF GEARS

When the center distance and the ratio of two gears are known and the pitch radius of each gear is desired, divide the center distance by 1 plus the ratio to obtain the pitch radius of the pinion. Then the difference between the center distance and the pitch radius of the pinion equals the pitch radius of the gear.

Example—Given: Center distance between two gears, 12 1/4 inches; revolutions per minute of pinion, 8; revolutions per minute of gear, 6.

To find: Pitch radius of pinion and of gear

$8/6 = 1\ 1/3$, ratio of gears

$1 + 1\ 1/3 = 2\ 1/3$

$12\ 1/4 \div 2\ 1/3 = 5\ 1/4$, pitch radius of pinion

$12\ 1/4 - 5\ 1/4 = 7$, pitch radius of gear.

If the diametral pitch has been selected and the center distance between the gears is known, the number of teeth in the pinion equals twice the center distance times the diametral pitch divided by 1 plus the ratio. The number of teeth in the gear equals the number of teeth in the pinion subtracted from twice the center distance multiplied by the diametral pitch.

Example—Given: Center distances between two gears, 12 1/4 inches; revolutions per minute of pinion, 8; revolutions per minute of gear, 6; diametral pitch, 4.

To find: Number of teeth of pinion and number of teeth of gear

$$\frac{12\ 1/4 \times 2 \times 4}{1 + 1\ 1/3} = 42, \text{ teeth in pinion}$$

$$12\ 1/4 \times 2 \times 4 - 42 = 56, \text{ teeth in gear.}$$

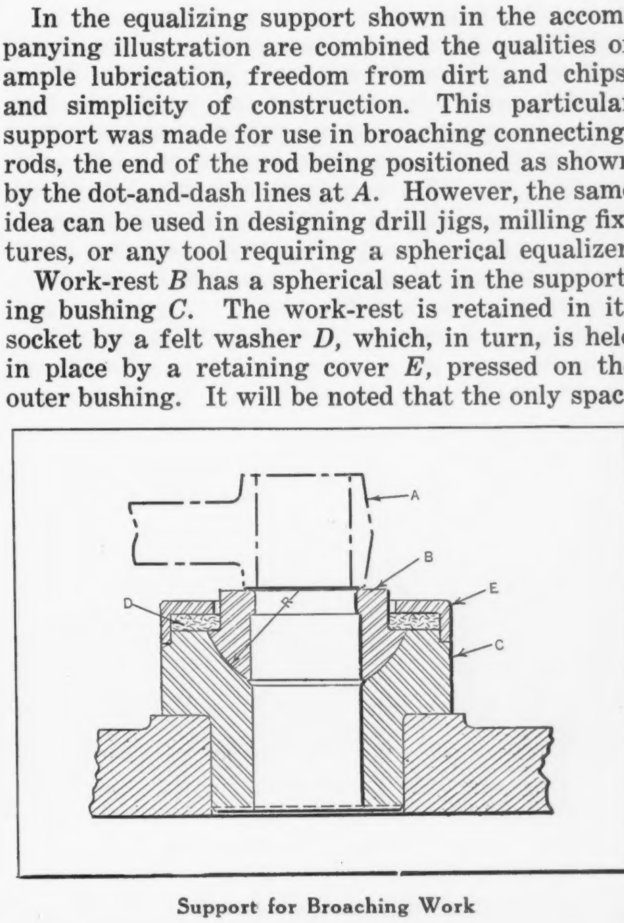
Note: In this last example if the center distance had been 12 inches instead of 12 1/4, the number of teeth would have been 41 1/7. It will be seen from this that in order to retain an even diametral pitch, flexibility of center distance would be required.

Blue Ash, Ohio P. R. KEMBLE

EQUALIZING SUPPORT FOR BROACHING WORK

In the equalizing support shown in the accompanying illustration are combined the qualities of ample lubrication, freedom from dirt and chips, and simplicity of construction. This particular support was made for use in broaching connecting-rods, the end of the rod being positioned as shown by the dot-and-dash lines at *A*. However, the same idea can be used in designing drill jigs, milling fixtures, or any tool requiring a spherical equalizer.

Work-rest *B* has a spherical seat in the supporting bushing *C*. The work-rest is retained in its socket by a felt washer *D*, which, in turn, is held in place by a retaining cover *E*, pressed on the outer bushing. It will be noted that the only space



Support for Broaching Work

in which chips can collect is the space between the work-rest and the retainer, but as any motion of the work-rest is substantially vertical at this point, the chips will not interfere with the free motion of the work-rest. The oil or other lubricant falling on the felt washer is conveyed by the wick action of the felt to the spherical bearing surface.

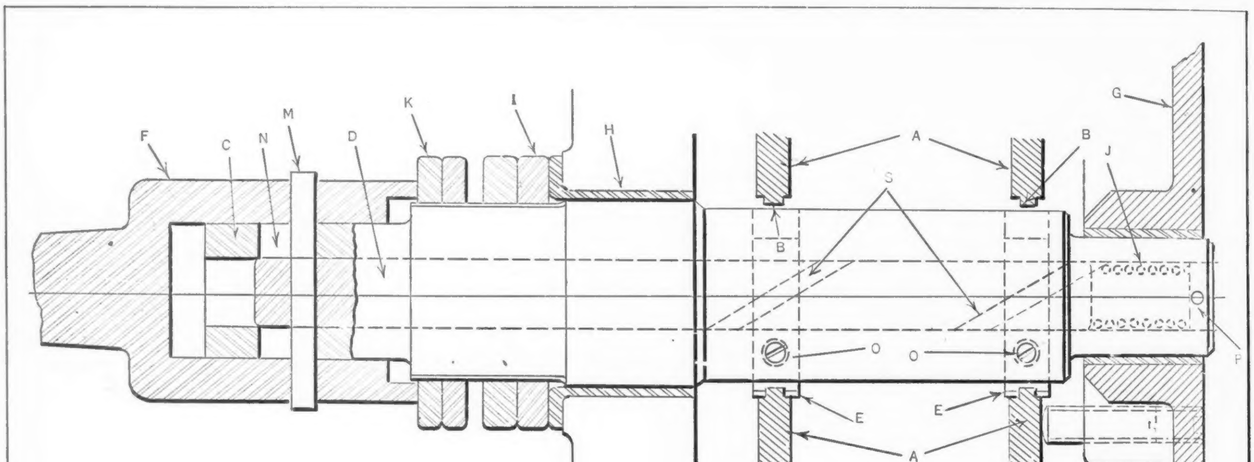
Milwaukee, Wis. E. J. BERRY

BORING-BAR FOR FINISHING TWO BEARINGS SIMULTANEOUSLY

The boring-bar shown in the accompanying illustration is designed for boring two bearing holes in a gray iron casting in one operation. Although shown in a horizontal position in the illustration, the boring-bar is held in the spindle of a drilling machine and operates in a vertical position. The work *A* is required to be turned to the form shown at *B*. The main parts of the tool are the boring-bar *C*, the hardened camshaft *D* for feeding the cutting tools *E* downward, and the driving sleeve *F*. The illustration shows the work *A* in place in the drill jig with the cutters *E* in the operating position. The boring-bar is used in connection with the drill jig *G*, being guided by the drill bushing *H*. The collar *I* serves as a stop against bushing *H*.

When collar *I* comes in contact with bushing *H*, the continued downward movement of the spindle causes the camshaft *D* to slide downward through the boring-bar, compressing spring *J* and feeding the cutters *E* outward into the working position. The downward movement of the boring-bar is finally stopped when driving sleeve *F* comes in contact with the collar *K*, the setting of which determines the size of the hole that will be bored in the work.

An angular groove *S*, cut in the shank of each cutter *E*, fits a tang cut on the camshaft *D* at the angle required to give the necessary downward feeding movement to the cutters. The boring-bar is driven from the driving sleeve *F* through the pin *M*. The boring-bar *C* has an elongated hole *N* in it, which permits pin *M* to have a limited sliding movement. Two screws *O* in the boring-bar are adjusted to prevent any looseness or play of the cutters in their respective slots.



Tool for Form-boring Two Bearings in One Operation

The boring-bar is bored out to receive the camshaft *D*. After the spring *J* has been inserted, the plug *P* is put in place and retained by a pin. The tool described is used in boring the bearing holes in castings machined in comparatively large lots, and has proved a great time-saver.

Rockford, Ill. WALTER E. GUNNERSON
EDWARD R. JOHNSON

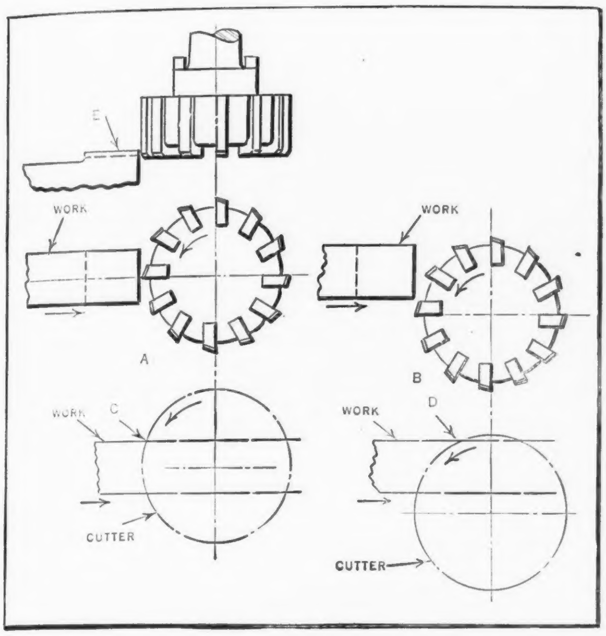
IMPROVED METHOD OF SETTING MILLING CUTTER

The milling cutter shown in the accompanying illustration is used on a production milling job. The old and new methods of setting the cutter are shown in the diagrams at *A* and *B*, respectively. The work to be milled is an iron casting having three pads like the one shown at *E*. The amount of stock removed from each of the three pads is approximately 1/8 inch. About 800 of these castings are milled per day, using a 4-inch cutter having inserted stellite blades.

The cutter is run at a speed of 130 revolutions per minute, with a feed of 12.6 inches per minute. Considerable trouble was experienced at first, due to the chipping of the cutting edges of the teeth after a short run, and it was often necessary to grind the points of the cutters back for a distance of 1/4 inch in order to put them in first-class shape.

The method of eliminating this trouble is very simple, although it was overlooked for a long time. Originally the cutter was located as shown in diagram *A*, with the center line at the same height as the center of the pad to be milled. With this setting, each tooth was required to take a deep cut as soon as it came in contact with the work at *C*. The heavy chip taken at the start of each cut by each individual tooth caused the teeth to be chipped. This difficulty was overcome by lowering the cutter to the position shown in the diagram at *B*.

With the cutter set about an inch below the center of the work, as shown at *B*, a better finish was obtained, the noise of the machine gearing was reduced, and the length of the cutter life trebled. Referring to the diagram, it will be obvious that only a thin chip is taken at the point *D* where the



Old and New Methods of Setting Milling Cutter

tooth enters the work. Although the feed was increased somewhat, the time required in finishing a pad was greater with the second than with the first method. However, this and several jobs of a similar nature have proved to the writer's satisfaction that the shortest route in milling a surface is not always the most economical.

Syracuse, N. Y. ELMER C. COOLEY

OVERSHOT FORMING TOOL FOR TURRET LATHE

The overshot form-turning tool for a turret lathe shown in Fig. 1 is used in finishing the inner surfaces of the brass casting *W*, as indicated by the finish marks. The tool differs in several respects from the ordinary overshot type of tool. The casting *W* is gripped on its finished outside surface by an ordinary three-jaw chuck mounted on the spindle of a hand turret lathe. The central projection *A* is first turned and faced by a standard box-tool, after which the form-turning tool is brought into operation.

In order to turn the inside surfaces without any interference or dragging of the tool, it is necessary to place the tool at the top of, and tangential to, the work, at a compound angle with respect to the face of the work. As shown in the illustration, the tool bit *B* is at an angle of 20 degrees with the horizontal center line of the work and at an angle of 7 degrees with the vertical axis. By setting the tool in this position and grinding the face *C* of the tool bit *B* even or flush with both central lines of the work, it is evident that the cutting edges of the tool will have a clearance in all directions, so that a free cutting action is obtained.

The machine steel body *D*, the shank of which is clamped to the turret of the machine, is slotted at *E* to receive the tool bit *B*. Body *D* is also drilled and tapped to receive the two set-screws *F*. These set-screws force the tool bit down on the rocker *G*, which is provided with a seat at the bottom of the slot *E* and placed as close to the edge of the tool as possible. The angle of the tool face *C* can be varied slightly to suit conditions by unscrewing one of the set-screws and tightening the other.

An overshot forming tool is likely to chatter unless it is securely guided in some way. To provide the necessary guidance or support, a ball bearing *H* is fitted in the sleeve *J*, where it is retained by the plate *K*. This sleeve moves back and forth in the hole *L* in the projecting boss *M* of body *D*. A spring *N* forces this slide against the retaining plate *O* which is fastened to the boss *M*. The hole in the ball bearing *H* fits the center projection *A* of the work. When the forming tool is fed in, the projecting ball bearing slides over boss *A* until it is stopped by the shoulder on the boss. The tool, being pushed forward to take the cut, causes slide *J* to move back against the action of spring *N* while the ball bearing spins with the rotating work. The forming tool is thus guided and supported by the work itself during the forming operation.

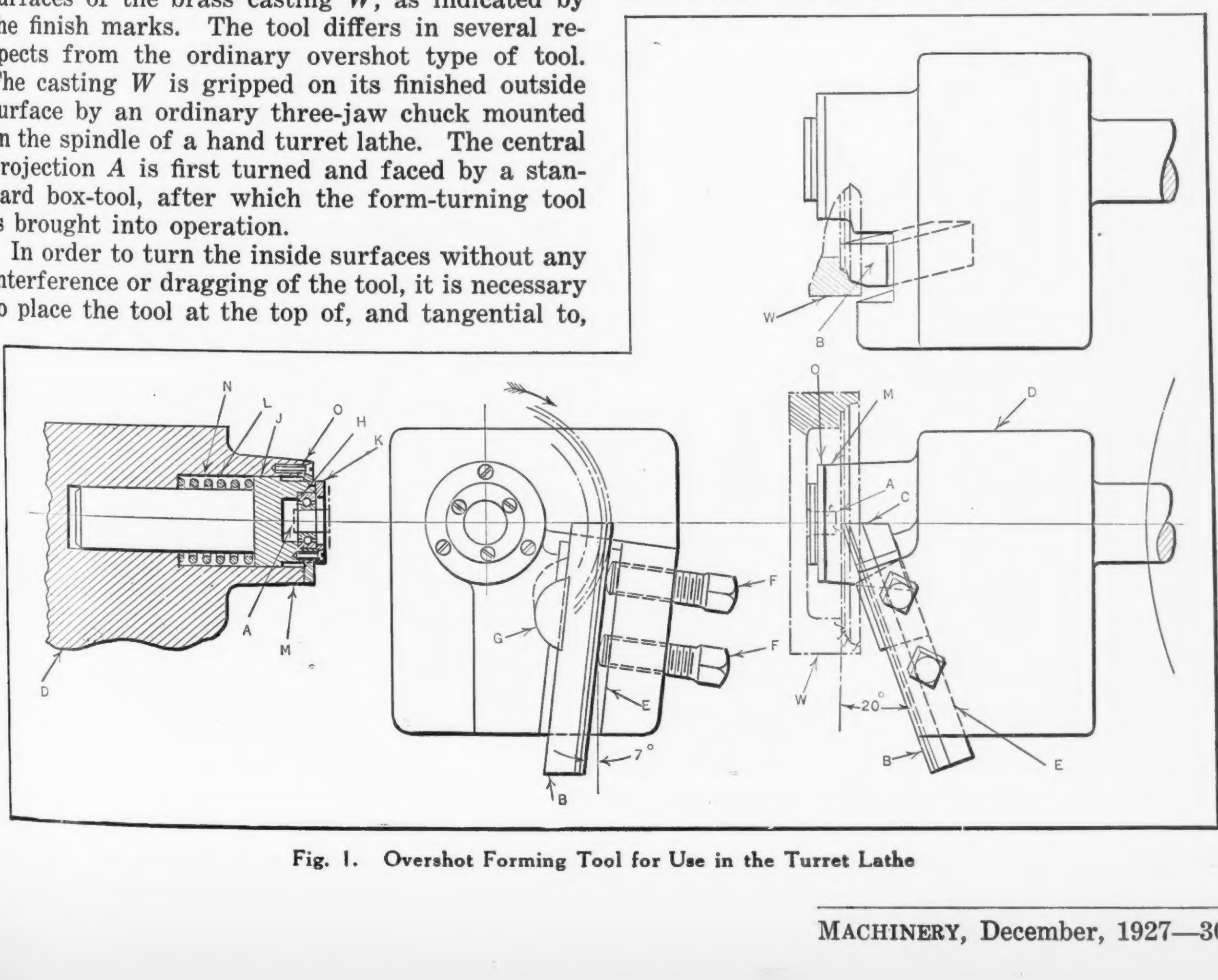


Fig. 1. Overshot Forming Tool for Use in the Turret Lathe

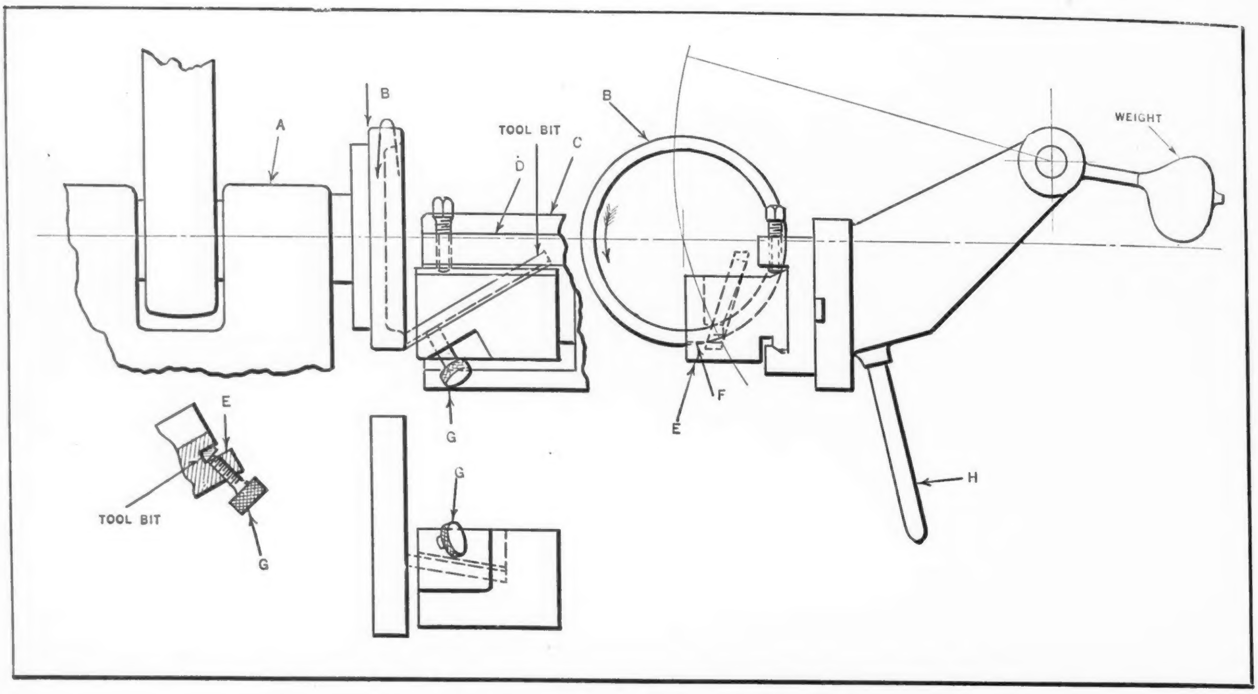


Fig. 2. Equipment for Grinding Tool Bit B, Fig. 1

It is obvious that a tool of the type described will operate efficiently only so long as its cutting face is ground to the correct angle. When correctly ground, the cutting face will be in line with both center lines of the work. In the plant where this and tools of similar design are used, it was formerly the practice for each operator to grind his own tool bits when they became dull, with the result that a great deal of trouble was experienced. As it was obvious that uniform grinding of the tool shown at *B* was necessary in order to obtain good results, the apparatus shown in Fig. 2 was developed for use in grinding this and other tools of a similar design.

The Besly grinder *A* shown in Fig. 2 is equipped with a wide-rim cup-wheel *B*. An adjustable swinging table *C* is mounted on this machine in front of the wheel. Clamped to the front of table *C* is the adapter plate *D*, which has a wide slot cut across its top surface, one side of which is finished at an angle as shown. An individual block *E* is made up for each tool bit to be ground. A slot *F* at the proper angle or compound angle to suit the particular tool to be ground is cut across this block, and the tool bit, which is a close fit in this slot is clamped down by means of the screw *G*, leaving the end of the tool projecting. Block *E* is then clamped in the adapter plate *D* by a set-screw in such a position that the finished angular side of the block is held in contact with the angular side of the slot in plate *D*, the block *E* being drawn down against the plate.

Next the table *C* is fed in by operating a handwheel. The projecting tool is thus brought into contact with the grinding wheel. The table is then swung back and forth across the wheel by operating the handle *H*. Meanwhile, the table is adjusted or moved inward after each swinging movement until a good cutting face has been ground on the tool bit. Individual blocks for holding the tool bits and the grinding machine are located in the department where the forming tools are used. It is the practice to have several duplicate tool bits for each job, so that when one becomes dull it may be quickly replaced with a sharp tool.

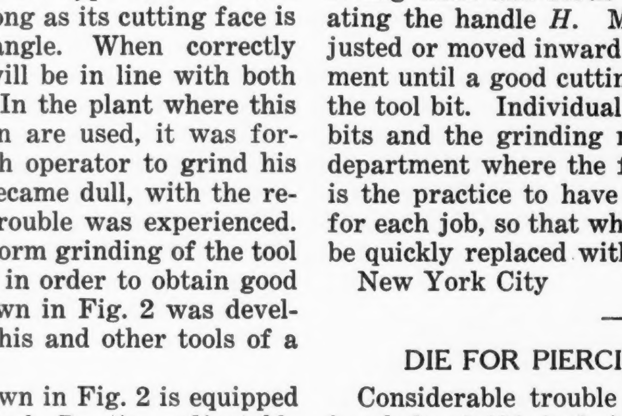
New York City B. J. STERN

DIE FOR PIERCING HEAVY STOCK

Considerable trouble was experienced in piercing holes 0.120 inch in diameter in metal stock 1/8 inch thick due to the breaking of the punches. Punches made from various kinds of steel were tried out without satisfactory results. Finally the writer redesigned the plain die as shown in the accompanying illustration. After this was done, no more trouble was experienced.

The stripper plate *A* was drilled, and fitted with hardened bushings *B*, which were a push fit over the punches. As trouble was experienced in lining up the punches, clearance holes were made in the punch pad *C* as illustrated. After placing the punches in the pad with the latter member loose, the punches were passed through the stripper plate *A* and into the die, after which the punch pad was tightly clamped to the holder *D*. The punches were thus clamped securely while lined up in the holes in the die and in the guide holes in bushings *B*.

CHARLES KUGLER
Philadelphia, Pa.

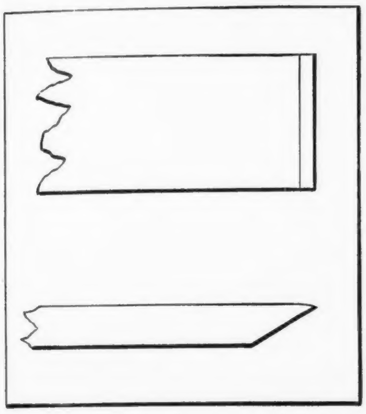


Die for Piercing Heavy Stock

Shop and Drafting-room Kinks

HAND TOOL FOR TURNING WORK ON LATHE FACEPLATE

There is a greater tendency for the hand tool to "dig in" in turning work mounted on the faceplate of a large lathe than is usually experienced in turning work in smaller lathes where the work is held between centers. The difficulty is sometimes due to the large number of pieces glued together to make up the part, each of which has a different hardness and direction of grain. Also, a faceplate 10 feet in diameter is likely to weave considerably, owing to the fact that the work is unbalanced.



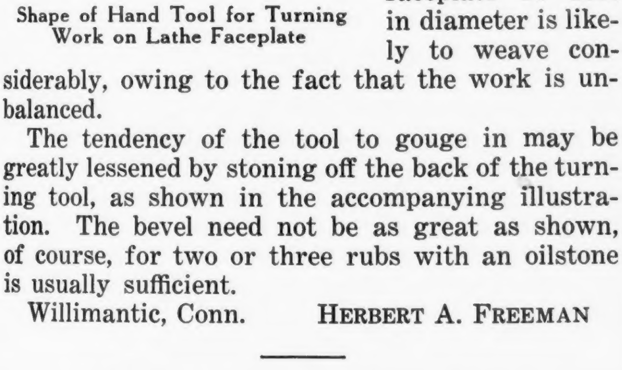
Shape of Hand Tool for Turning Work on Lathe Faceplate

The tendency of the tool to gouge in may be greatly lessened by stoning off the back of the turning tool, as shown in the accompanying illustration. The bevel need not be as great as shown, of course, for two or three rubs with an oilstone is usually sufficient.

Willimantic, Conn. HERBERT A. FREEMAN

SLOTTING FIXTURE FOR SCREWS

One of the simplest screw-head slotting devices imaginable is shown in the accompanying illustration. In using this device, a slitting saw is mounted on the arbor of a milling machine, and the base or shank *A* of the fixture is clamped in the milling machine vise in such a position that the slitting saw runs in the slot *B*. The height of the milling machine table is then adjusted to give the required depth of cut. The screws to be slotted are inserted in the slot of the device at *C* and are pushed along by means of the lever *D*.



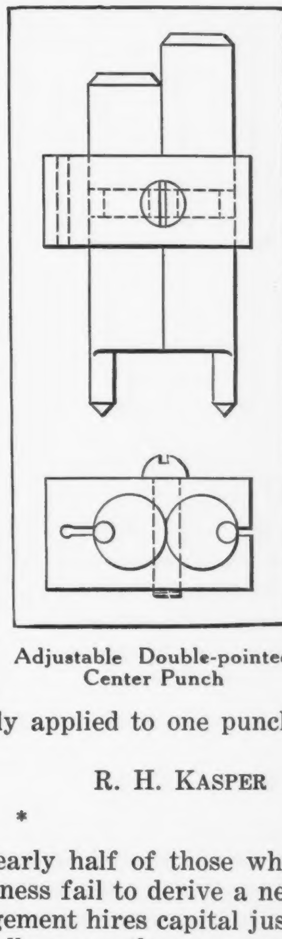
Slotting Fixture for Round-head Screws

After the guiding slot in the fixture is once filled, a screw is slotted at each stroke of the feeding lever. The operator places a screw in the slot with his left hand after each stroke of the lever, which is operated continuously with the right hand. Machine screws of ordinary size can be slotted as fast as the operator can manipulate the handle, provided the milling saw is run at its maximum speed. The main part or shank end of the tool is made of cast iron, but the remainder of the tool is made from cold-rolled steel which is casehardened on the surfaces subjected to wear.

Cleveland, Ohio AVERY E. GRANVILLE

ADJUSTABLE DOUBLE-POINTED CENTER PUNCH

The accompanying illustration shows the construction of an adjustable double-pointed center punch which has a wide range of adjustment. It will retain its setting and is easy to make. The two punches are made with the punch sections eccentric with the shank section. Any setting can be secured by merely turning one or both punches. The retaining or clamping block is drilled so that the two holes for the punches are tangent. It is slit the greater part of its length, and the clamping screw is so placed that both punches will be firmly clamped when the clamping screw is tightened. Both punches are grooved to provide clearance for the clamping screw, as shown by the dotted lines. One punch is made longer than the other, so that the hammer blow may be easily applied to one punch at a time.



Adjustable Double-pointed Center Punch

Philadelphia, Pa. R. H. KASPER

* * *

So far as returns go, nearly half of those who make use of capital in business fail to derive a net profit from its use. Management hires capital just as it does labor; it is hardly more than an even break that its employment will be profitable. The personnel and capacity of management are the preponderant factors in profitable industry. If it were not for the demand for capital on the part of able management, the ownership of capital, odd as it may seem, would not be of much financial advantage.—*Commerce and Finance*

Questions and Answers

LIABILITY FOR PATENT INFRINGEMENT

C. F.—If a manufacturer infringes on your patent, can he be held liable for such infringement unless he has been given notice to discontinue the manufacture of the patented article?

A.—According to an article by Leo T. Parker in June, 1927, MACHINERY, page 783, it is necessary under the present patent law to mark the word "Patent," together with the number of the patent, upon the patented article. If the article is not so marked, the inventor is deprived of damages until after he has sent a notice to the infringer, calling his attention to the number of the patent. The law provides that "in any suit of infringement by the party failing to so mark, no damages shall be recovered except on proof that the defendant was duly notified of the infringement and continued after such notice to make, use, or vend the article so patented." This implies that the word "Patent," together with the number of the patent, marked on an article, constitutes sufficient notification, and in such a case, it is not necessary to give any further notice.

WHY ARE MULTIPLE-THREADED HOBS USED?

A. B. C.—In cutting spur gears by the hobbing process, why are double- or even triple-threaded hobs sometimes used instead of a single-threaded hob?

A.—A multiple-threaded hob will reduce the actual cutting time in direct proportion to the number of threads, as compared with a single-threaded hob of equal size, having the same speed and feed. A single-threaded hob, however, generates more accurate teeth, and it is the type commonly used.

The reason that a hob having a double or triple thread reduces the cutting time in proportion to the number of threads will be evident by considering a specific example in which the performance of a single-threaded hob is compared with that of a double-threaded hob.

Assume that the gear to be hobbed has forty teeth, the hob feed per gear revolution is 0.1 inch, the total hob travel 2 inches, and the hob speed 100 revolutions per minute. In using a single-threaded hob, the gear will revolve 20 times while the teeth are being cut, since $2 \div 0.1 = 20$; hence, the hob makes $20 \times 40 = 800$ revolutions while traveling 2 inches, and as the hob speed is 100 revolutions per minute, the actual cutting time equals $800 \div 100 = 8$ minutes.

Assume now that the same gear is to be cut with a double-threaded hob. If the feed is still 0.1 inch per gear revolution, 20 gear revolutions will be required for a total hob travel of 2 inches as before. The hob, however, makes 20 revolutions to one of the gear, instead of 40, as with the single-threaded hob. Now since the double-threaded hob also rotates 100 revolutions per minute, the gear will have a speed of $100 \div 20 = 5$ revolutions per minute, instead of $100 \div 40 = 2\ 1/2$ revolutions per minute, as for a single-threaded hob. Consequently, if the double-threaded hob feed is 1/10 inch per gear revolution, it moves $1/10 \times 5 = 5/10$ inch per minute, and it travels the required 2 inches in $2 \div 0.5 = 4$ minutes. This time, as will be seen, is one-half that required for a single-threaded hob, because the gear blank rotates at twice the speed when using a double-threaded hob.

If a similar comparison were made between a single-threaded and a triple-threaded hob, it would be found that the latter would require only one-third the cutting time needed for a single-threaded hob. The triple-threaded form is sometimes used for cast-iron gears which do not need to be very accurate. When multiple-threaded hobs are used for steel gears, ordinarily the double-threaded form is employed.

MARKING INVENTIONS "PATENTED" AFTER PATENT EXPIRATION

H. P. R.—Please inform me whether or not there is legal liability if an inventor continues, after the patent has expired, to mark his inventions "Patented," with the date the patent was issued.

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

There is no legal liability, if after a patent has expired, a patentee continues to mark his manufactured articles "Patented," followed by the date on which the patent was issued. Where the date is included in the notice, observers are informed truthfully and may readily determine that the patent is ineffective. However, although no cases are found involving the point, it is believed there would be a misrepresentation if the articles are marked "Patented," without including the date of the expired patent.

There is record of a litigation involving the use of the mark "Patent Applied For," in which it was disclosed that an inventor thus marked his invention for which no application for a patent had been filed. In this case, legal proceedings were instituted against the user on the grounds of fraud and misrepresentation, and the Court held that the marking of the invention in this manner, under these circumstances, actually constituted an offense.

The penalty for falsely marking articles "Patented" is a fine of $100 for each offense, with other stipulations; but the law does not prescribe a penalty for use or misuse of the terms "Patent Applied For" or "Patent Pending." These terms have been adopted by inventors without statutory authority, although the proper use of them is lawful.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

CINCINNATI "GIANT HYDROMATIC" MILLING MACHINE

The Cincinnati Milling Machine Co., Cincinnati, Ohio, has placed on the market a new high-production automatic milling machine known as the "Giant Hydromatic," which was introduced to the mechanical public at the Cleveland Exhibition of the National Machine Tool Builders' Association. The outstanding feature of this machine is a hydraulic table feed. In this application of a hydraulic feed, there is positive pressure on both sides of the piston.

In developing the machine, a particular effort was made to make the structure as strong and rigid as possible, without destroying the simplicity and ease of operation. The general structure of a modern planer, usually known as the heaviest type of machine tool, was followed, particularly the long bed for supporting the table and the rugged housings for supporting the cutting tool. This construction not only allows wide beds to be used, but at the same time enables multiple-spindle units to be applied, either horizontally or vertically, or in a combination of both arrangements.

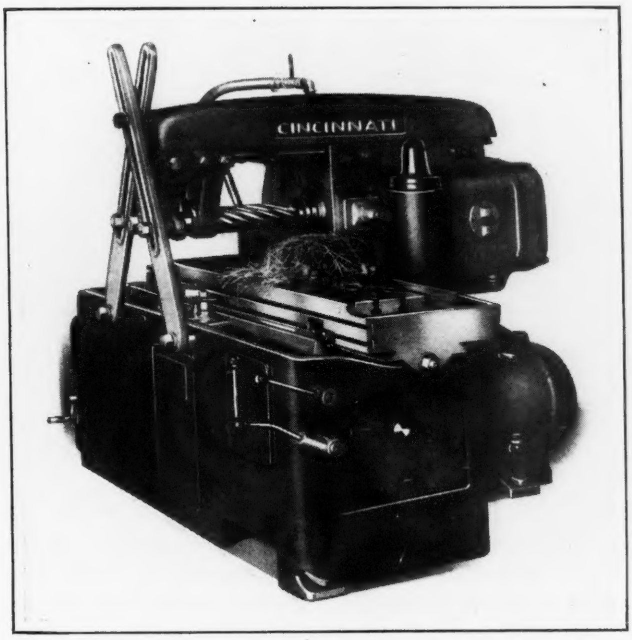


Fig. 1. Cincinnati "Giant Hydromatic" Milling Machine

The housings which carry the spindle driving unit are of generous dimensions and of box-type section, heavily ribbed and particularly designed to minimize all deflections when cutting. The lower compartment contains on one side the motor and on the other side the preliminary driving units, such as multiple-disk friction clutch and spindle reverse mechanism. The upper part carries the spindle carrier guided by large surfaces with the well established narrow guide principle.

The spindle carrier is a self-contained unit in which the whole gear transmission, including the spindle speed change-gears, are mounted; it also carries the large quill which provides for the lateral adjustment of the cutter, and which is rigidly clamped in the spindle carrier around its full diameter, by one bolt, allowing no movement of the quill under the heaviest lateral loads.

Table and Bed Construction

The table is mounted directly on the bed, which is of unusual design, to meet the problem of disposing of the great amount of chips and also the large volume of cutter coolant, by utilizing the large accessible chamber underneath the table. The portion of the bed that carries the table is of tubular cross-section, made integral with the side walls by cross bridges spaced far enough apart to allow free passage of the longest chips falling from the table. A large door allows for quick removal of the chips. This bed structure permits a large strainer to be used inside the bed, so that the coolant can return to the reservoir even if the strainer is completely covered by chips. The bed construction provides simple means for attaching splash guards, so that the coolant is absolutely confined inside the table area.

The rear end of the bed carries in a separate chamber the self-contained "Hydromatic" feed unit with pump, valves, and oil reservoir. The table bearings on the bed are the full width of the table. The overhanging of the table in its extreme positions never exceeds more than one-fourth of the table length. The table is designed on the same principle as surface plates, where heavy ribbing maintains a flat surface and provides resistance against deflection.

Why Automatic Control of Feed was Adopted

At the present time, the rates of traverse provided on milling machine tables vary through a wide range, many milling machines having a feed range of from 1/2 inch to 30 inches per minute. To cover such a wide range with a mechanical feed-change mechanism requires a large number of gears. As usually arranged, the mechanism provides a feed rate advancing in a geometric progression, and even an increment of 20 or 25 per cent might not give the most economical feed rate. It is, therefore, desirable to have as large a number of feed changes and as close a spacing as can be provided.

Frequently the amount of metal to be removed on various sections of a piece varies considerably. Stock may be removed at one place at the rate of 10 cubic inches per minute and at another place at the rate of 3 cubic inches. For production work it is impracticable to change the rate of feed manually during the cutting operation. It is, however, desirable that such an automatic change of feed rate shall be obtained for maximum production.

In other classes of work it is desirable that when the cutter enters the work the feed rate shall be slow, so that the work will not be lifted out of the fixture or vise. Later the feed rate may be materially increased. On work where feeding against a shoulder or into solid metal is required, automatic decrease of the feed is desirable, thus increasing the production and raising the grade of finish.

Frictional feed devices provide the required flexibility, but lack positiveness and durability. Mechanical devices give positive feed, but lack flexibility. The hydraulic system to be described, as embodied in the new machine, meets these conflicting requirements.

General Characteristics of Automatic Feed Control

In the application of hydraulics to the reciprocation of the milling machine table, the following operating characteristics have been provided: (1) Reciprocation in either direction at normal feeding rates, and (2) at rapid traverse rates; (3) positive control of feeding movement, regardless of the direction or the amount of cutting force; (4) a locked table when in the stopped position, so that it will not move under the action of the cutter; (5) accurate reversal of the table under any cutting condition; (6) a readily controlled acceleration or deceleration of the feed; and (7) economical operation.

Fig. 2. Duplex Type of Cincinnati Milling Machine Shown in Fig. 1

Items 3, 4, and 5 are particularly necessary when the cutting force is in the same general direction as the normal feeding movement. This condition frequently occurs in face milling, when the work surface engages with the cutter on the lower portion only. It also occurs in certain classes of slab-milling and slot-milling work, where a downward movement of the cutter is advantageous.

The operating characteristics mentioned have been obtained by the use of a combination of pumps and auxiliary devices arranged to provide a locked control system—the outcome of a great deal of experimental work.

The Feeding Circuit

Fig. 5 shows in diagrammatic form the arrangement of the elements involved in the feeding circuit. Cylinder *C* is bolted to the bed and carries a sliding piston *P* connected to the table by a piston-rod. *V* is a reversing valve; *O*, an Oilgear variable-displacement pump; and *B* a small high-pressure booster pump, cooperating with *O* to produce a continued forward pressure upon the piston *P*, the amount of this pressure being determined by the setting of the relief valve *R*.

The space within the cylinder on both sides of the piston is always completely filled with oil; consequently, in order that the piston may be moved in a given direction by means of the forward pressure, it is necessary that the oil on the other side be able to escape. If no escape is permitted, there will be no movement of the piston; if some escape is permitted, then the piston will advance just as fast as the escaping oil will allow it; and with a positively controlled escapement, the rate of advance is virtually independent of the amount of forward pressure.

From Fig. 5 it is evident that the only avenue of escape for the oil from the rear end of the cylinder is by way of the pipe *D* through the reversing valve and thence through the Oilgear pump. Consequently, the quantity of oil permitted to escape from the cylinder is definitely fixed by the displacement of the Oilgear pump. As the displacement of this pump may be varied at will from zero to maximum, it is obvious that in this way the forward rate of the table may likewise be varied from zero to maximum. Furthermore, the feed rate is determined, not by the amount of oil fed to the cylinder, but by the amount permitted to escape from the discharge end. In this way a high back pressure is built up to resist the movement of the piston.

The amount of this back pressure is not constant, but varies with the direction and amount of the resultant cutting force. In the case of a cut against the direction of the feed, the back pressure is approximately equal to the forward hydraulic pressure minus the horizontal component of the cutting force; in the case of a cut with the direction of the feed, the back pressure is approximately equal to the forward hydraulic pressure plus the horizontal component of the cutting force. The exact back pressure in each case is dependent also upon the amount of frictional resistance encountered by the table and upon the ratio of the effective areas of the two sides of the piston.

The circuit described pertains to the movement of the table at feeding rates only. To provide, in addition, a high table speed for rapid approach to the work and rapid return, use is made of an auxiliary, large-volume, low-pressure gear pump.

The Combined Circuit for Feeding and Rapid Traverse

For the sake of simplicity, the feeding and rapid-traverse circuits have been separately described. In actual practice, both circuits are interconnected and operated by a common control valve arranged to provide both a reversal of table movement and a change of speed from feed rate to rapid traverse, or vice versa. This is accomplished by a valve having both reciprocatory and oscillatory motion.

Advantages Gained by the Use of Hydraulic Feed

The following advantages are gained by the use of the hydraulic feed: (1) Flexibility of feed control: (a) Any desired feed rate from zero to maximum is obtainable. (b) Automatic change of feed rate during cut is possible, thus providing maximum metal removal. (c) Any desired cycle of feed and quick traverse in either direction, together with automatic stop or feed change at any point can be obtained. (d) Milling in a given direction, until the table encounters a positive stop, then dwelling to allow cutter to clear itself, and after a predetermined short interval of time, automatic returning of the table at a rapid traverse rate is possible. (e) Accuracy of trip is obtained, owing to the fact that no clutches or other mechanical devices are employed. Tripping is assisted by the particular valve design used, which provides a balanced condition at all times.

Item (b) is particularly valuable in production milling wherever the width of piece to be milled is not uniform throughout its length. Ordinarily, it is necessary to limit the feed rate for the entire piece by the proper rate for the widest part. With the hydraulic system, a simple cam may be arranged as shown in Fig. 4 to automatically adjust the feed rate to the amount desired for each successive table position.

2. Longer cutter life. In the application of hydraulics to broaches, drilling machines, and other machine tools, an exceptional increase in the life of the tool has been noticed, and the same effect has been found to exist in the case of the hydraulic-feed milling machine.

3. Efficiency of metal removal. Practical tests covering a wide variety of work have indicated higher efficiency of metal removal per horsepower by the use of the hydraulic feed.

4. Safety. The entire feeding transmission is automatically safeguarded against overloading by the action of the relief and control valves. During the experimental work it frequently happened that the machines and cutters were overloaded to a point where the feed mechanism was stalled, and occasionally the work slipped from its proper position. In no case, however, was the machine or cutter seriously damaged.

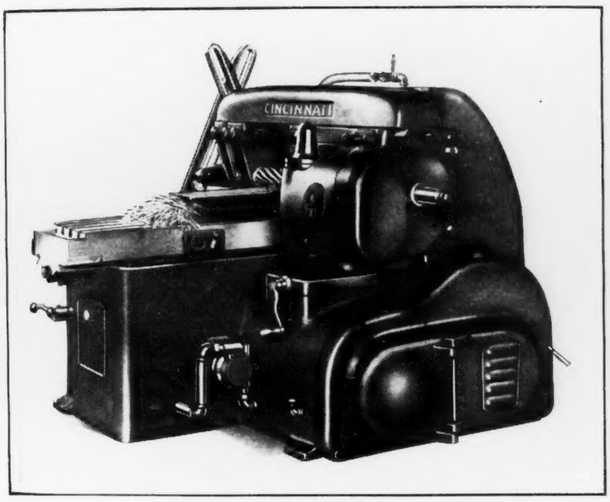


Fig. 3. Rear View of Machine, Showing Enclosed Motor Drive

5. Simplicity. The hydraulic feed mechanism, as a self-contained unit, is simpler than a corresponding mechanical feed transmission.

Drive of the Machine

The drive is through a motor, enclosed in the housing, to a first drive shaft by means of a silent chain which is automatically lubricated. This first shaft carries a multiple disk friction clutch and a set of bevel gears which provide for changing the direction of rotation of the spindle. One of the bevel gears in the reverse mechanism is used as a driver of the vertical shaft from which, by means of a set of reduction bevel gears, the change-gears are driven. The latter are mounted solidly on the shaft by means of a steep taper and a locking nut, facilitating their removal when speed changes have to be made.

The second change-gear shaft also carries the back-gear pinion from which a very large face gear is driven. This entire mechanism is lubricated by means of an oil-pump continuously circulating oil over all bearings and gears. All shafts, including the spindles, run on Timken roller bearings, and the spindle itself runs on the company's four-bearing self-compensating spindle mounting.

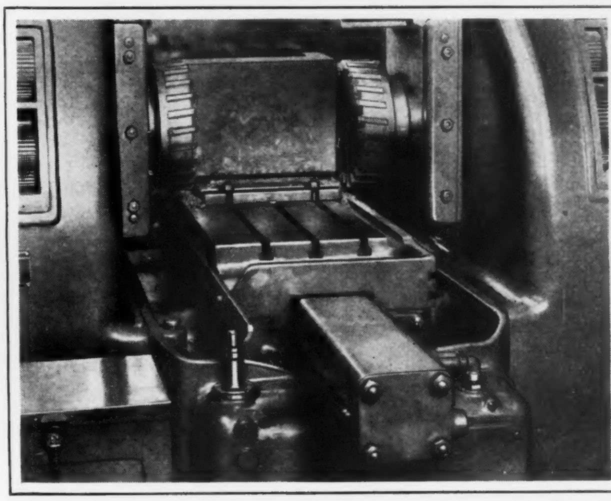


Fig. 4. Cam Arrangement for Automatically Controlling Hydraulic Table Feed

General Features of Construction

All levers for operating are located at the working position of the operator. A starting lever operates the friction clutch, and to quickly stop the machine, engages a brake. A second lever controls the feeding mechanism, and has four positions, two positions resulting in power quick traverse of the table in either direction, while the other two positions give a feed to the table in either direction. The positions of this lever indicate the direction in which the table is moving. A third lever starts and stops the table movement, whether fast or slow. The automatic control of the table is similar to the one used on the mechanically operated Cincinnati automatic milling machine.

A single plunger with oscillatory and reciprocating movement, controls the valve of the hydraulic feed mechanism, while dogs, set on the table, operate this plunger, giving to the table the movement desired. Any cycle of milling, either the one-way

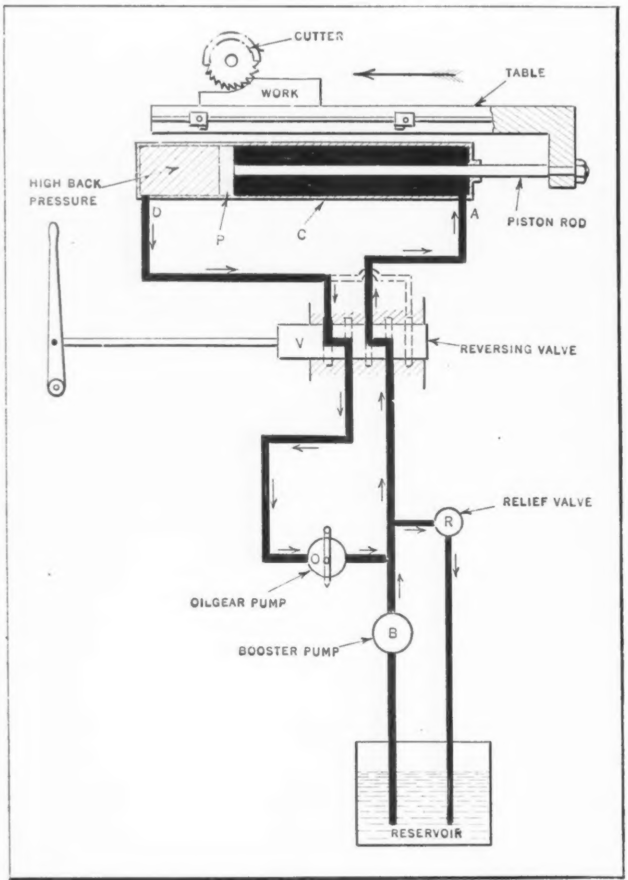


Fig. 5. Diagrammatic View of the Hydraulic Feed

feeding cycle with automatic quick return of the table, or the reciprocating cycle automatically controlled for fast and slow feeding in either direction can be obtained. Means are also provided so that the spindle can automatically be stopped on the return movement of the table.

Adjustments for setting up the machine, such as raising and lowering the spindle carrier and the in and out adjustment of the quill, are made from one position. All bolts for loosening and tightening the various elements can be operated with a single wrench in the same position.

The machine can be provided with a flooded lubrication system for supplying coolant to the cutter. A centrifugal pump delivering 20 gallons per minute is used. All running parts, including the table, are automatically oiled and do not need attention more than once a month. Only one place on the machine requires daily oiling.

The machine is built in plain and duplex types in a number of sizes varying in table travel from 36 to 72 inches and in table widths from 16 to 24 inches. The corresponding weights of these machines vary from 9500 to 18,000 pounds.

MICRO SPECIAL DIE GRINDER

A Model IG internal radius grinder, designed primarily for grinding radii on drawing dies, has been developed by the Micro Machine Co., Bettendorf, Iowa. The illustration shows a die used in drawing seamless tubing, mounted on the machine for grinding, but sheet-metal drawing dies can be ground as well. Radii of from 1 to 10 inches can be ground in holes varying from 10 to 25 inches in diameter and up to 6 inches in depth.

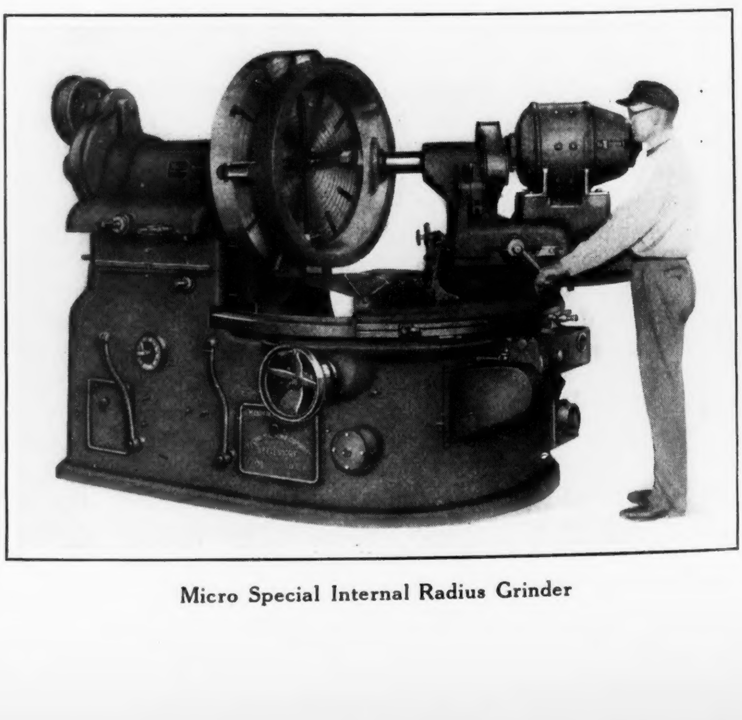
The grinding head and driving motor for the grinding spindle are mounted on a circular table which can travel through 65 degrees. The table pivots on a pin that is equipped with a roller bearing. It has a segment gear drive and is provided with reversing dogs and quick start and stop controls. To facilitate setting up, the table has both a hand and rapid power feed in addition to five feeds for various depths of cut. The table reverse gear-box is reversible by hand, in addition to having an automatic reverse.

The chuck headstock spindle is provided with an intermediate slide to permit longitudinal and transverse movements. Scales facilitate adjustments of the headstock for various radii. To obtain correct work travel, regardless of work diameter, the chuck speed is adjustable by means of a graduated dial on the operative side of the machine. This dial controls a taper cone at the rear of the machine.

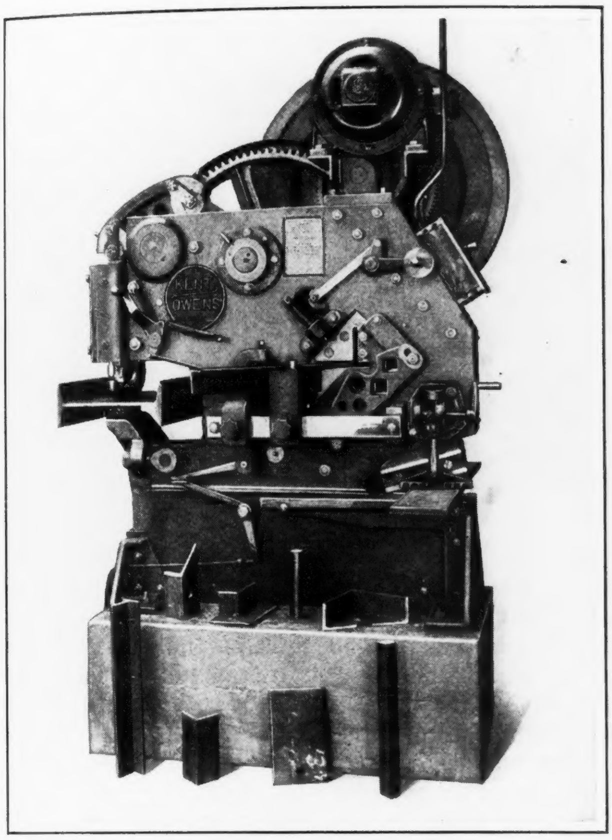
An intermediate slide provides longitudinal and transverse movements for feeding the grinding wheel to the work. The grinding wheel is equipped with a removable guard, and pulleys are furnished to give peripheral speeds to suit the work. A three-horsepower motor running at 1750 revolutions per minute is employed to drive the grinding wheel spindle. The headstock motor is of two-horsepower capacity and runs at 1150 revolutions per minute, while the exhaust fan requires a two-horsepower motor running at 1750 revolutions per minute. The net weight of the machine and standard equipment is approximately 12,700 pounds.

KENT-OWENS COMBINATION PUNCHING AND SHEARING MACHINE

The first of a line of machines designed for punching, cutting, and mitering structural sections and for shearing round, square, or flat bars and plates has recently been brought out by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio. An attachment also permits coping and notching operations. This machine is known as the "Kent-



Micro Special Internal Radius Grinder



Kent-Owens "Iron and Steel Worker"

Owens all-purpose iron and steel worker." The mechanism of the machine is so arranged that the punch may be operated independently of the other tools. Thus, one operator may punch holes while a second either cuts structural sections or bar stock, or shears plates.

A feature of the machine is the welded frame construction. The side members of the frame are rolled from open-hearth steel and electrically welded to intermediate forgings placed and shaped to provide maximum rigidity. The punch is full-floating and has an adjustable stroke. It may be brought down to the surface of the work by means of a hand-lever or else the stroke may be set so that the punch will always come to rest immediately above the work. This feature is especially convenient when punching material of varying thickness or when punching a large number of holes in material of uniform thickness. Holes may be punched in the web and flanges of I-beams, H-sections, channel irons, etc., without changing tools.

The bar cutter has an adjustable hold-down plate in which all openings are visible. Interchangeable upper and lower steel knives having four cutting edges each, are used in the shear. Lubrication of the machine is accomplished by means of a high-pressure Alemite grease system.

Holes up to 1 inch in diameter may be punched through 1/2-inch plate. Angle-irons up to 4 by 4 by 3/8 inch may be cut off square, and up to 3 by 3 by 1/4 inch, may be mitered to a 45-degree angle. Round bars up to 1 5/8 inches may be cut off and square bars up to 1 1/2 inches. The shear takes flat bars and plates up to 1/2 inch thick. The machine may be arranged with a motor drive as illustrated, or with a belt drive. The complete machine weighs approximately 3300 pounds.

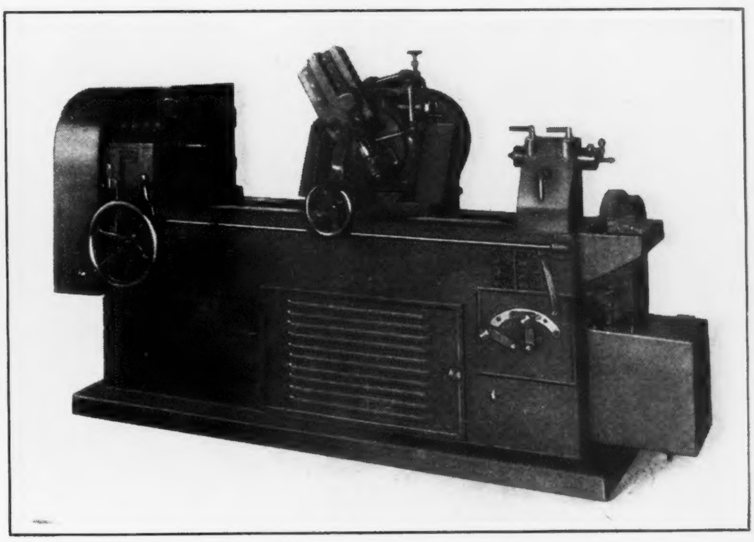
ADAMS GEAR HOBBER AND THREAD MILLER

A machine designed primarily for hobbing multiple spline shafts and hobbing or milling screws and worms, but which is also adapted to the production of small spur and helical gears, has recently been built by the Adams Co., 1910 Market St., Dubuque, Iowa. This No. 5 gear hobber and thread miller is driven by a motor in the base which is controlled by a reversing switch and push-button station. The motor is easily accessible through the front door. The drive includes a multiple-disk clutch (submerged in oil) and a Link-Belt silent chain that connects the motor to the speed gear-box.

A sliding gear transmission provides eight cutter spindle speeds, ranging from 70 to 350 revolutions per minute. Thirty-nine standard feeds are obtainable through pick-off gears, and other feeds are easily calculated for worms and screws having special leads. The balanced head drive imparts power smoothly to the cutter-spindle. This drive is mounted on New Departure double-row ball bearings. The location of the head permits chips to drop free, resulting in a smooth cut. A copious flow of coolant is available for cutting steel.

Accessibility of controls is an important feature of the machine. A handwheel controls the vernier setting of the head to any required angle, while the handwheel at the front of the cross-slide controls a micrometer setting for depth of cut. Located near the headstock are the push-button station for starting the motor, the clutch lever for starting the machine, the lever for engaging the feed, and the handwheel for operating the lead-screw. The lubricating system is designed to almost entirely eliminate the human element. The head mechanism operates in grease inserted by means of a large cup at the rear. Bearings and gears of all other units are lubricated by means of the Madison-Kipp fresh oil system.

When cutting splines or threads in the end of long shafts, the shaft is held in a chuck equipped with hardened jaws, which replaces the headstock center. A follow-rest on the cross-slide supports



Adams Gear Hobber and Thread Miller

the shaft rigidly in back of the cut. This machine will accommodate work up to 10 inches in diameter and up to 48 inches between centers. It regularly takes up to 3-inch diameter bars through the hollow spindle, but a special headstock can be supplied for 5-inch bars.

CINCINNATI RAIL-GUIDE PLANER

Eight rail guides 16 feet long can be planed simultaneously in a machine recently placed on the market by the Cincinnati Planer Co., Cincinnati, Ohio. Seven cutting tools operate on the sides and top of each rail, making a total of fifty-six tools being used at one time.

The rail of the machine is made exceptionally deep, and is provided with a power movement up and down so that it can be adjusted for different heights of rail guides. The one-piece tool-slide extends the full width of the machine and slides on a narrow guide. Two screws are used for raising and lowering the slide at either a feed or rapid traverse rate. The rapid traverse is obtained in the same manner as on the standard "Hypro" planer built by the same company, a reversible motor on top of the machine being used for this purpose. This motor is controlled by a switch on the right-hand end of the rail.

Front and rear tools are provided for each rail guide, the rear tools being placed in a separate bar that moves simultaneously with the slide and is also provided with a power rapid traverse and various feeds. This bar may be seen in Fig. 2. The forward slide can be raised out of the way when the rear tools need attention.

Automatic lifting of the forward and rear tools is obtained by means of an air cylinder which is operated from the table-shifting mechanism. With this provision, the tools are raised high enough to clear the top of the guides, and therefore, there is never any dragging of the tool edges. Cutting lubricant is supplied to all tools by a pump located at the left-hand side of the machine and driven from the main drive. When the planer stops, the pump also stops. The cutting lubricant is also cut off at each return stroke.

Fig. 1. Cincinnati Rail-guide Planer which Uses Fifty-six Tools

Fig. 2. View Showing Separate Bar for the Rear Tools

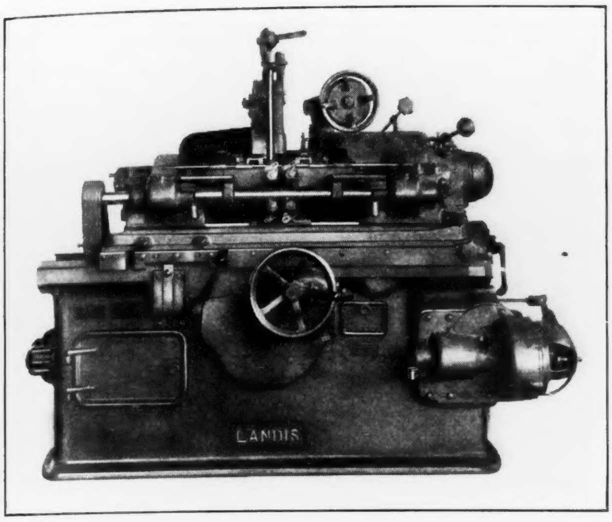
The bed is twice as long as the table, and its vees are furnished with forced lubrication. The housings have been cut down to suit the desired height of the machine, and they are tied together on top with the standard box arch used on Cincinnati planers. The gearing of the machine is capable of transmitting 125 horsepower, but an 85-horsepower motor drives the planer. With a cutting table speed of 90 feet per minute and a return speed of 180 feet per minute, eight rails can be finished in a floor-to-floor time of about twenty-five minutes.

LANDIS CRANKPIN GRINDER

Another hydraulic crankpin grinder known as the 10- by 16-inch, which is also available in a 10- by 32-inch size, has recently been placed on the market by the Landis Tool Co., Waynesboro, Pa. This machine is adapted to the production grinding of small motorcycle, refrigerator, or stationary-engine crankshafts, and may also be used on crankshafts of very small automobile engines.

On double-throw crankshafts, such as shown in the machine illustrated, the two end pins are ground first by simply truing from the rough forging, using a spacing bar and supporting each end pin with a work-rest. When the center pins are ground, a locating bracket is attached to the right-hand head, the spacing bar is changed, and the work-rests are moved to the two center pins. The use of a locating bracket enables the operator to bring the inside pins quickly on center before clamping the work in the carrying fixtures, while the spacing bar gives the operator facilities for speedily positioning the work carriage relative to the pin to be ground.

The work is driven from both ends through silent chains and sprockets. Quickly operated mechanical clamps hold the work in ground blocks. Rotation of the work, which is at a speed of 100 revolutions per minute, is controlled by a lever at the front of the machine.



Landis Hydraulic Grinder for Finishing the Pins of Small Crankshafts

A 30-inch diameter grinding wheel is used. A hydraulic power in-feed furnished to the grinding wheel head moves the wheel toward the work at high speed until it starts to grind. The wheel feed is then automatically slowed down to the predetermined grinding feed, and the wheel continues to move in at this slow feed until it comes against a positive sizing stop. The wheel then moves rapidly away from the work. Several convenient levers control the direction and rate of this hydraulic feed. A hand feed is also provided.

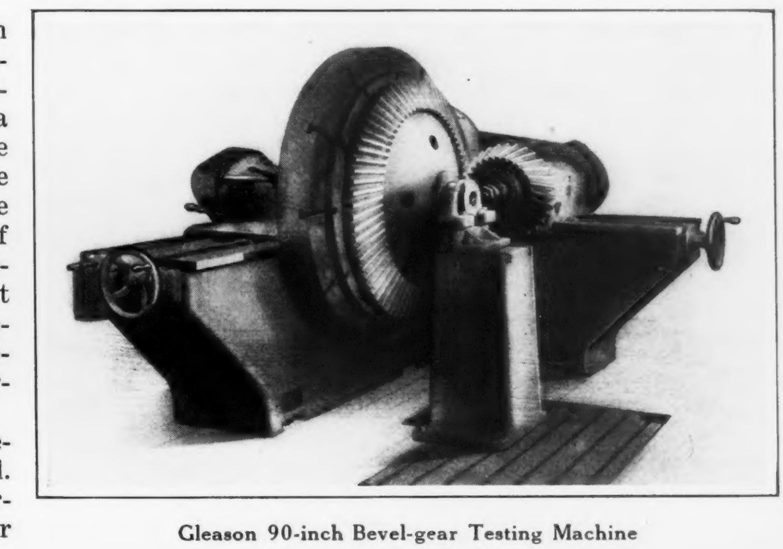
Power for the hydraulic wheel feed is furnished by a geared pump driven from the rear drive shaft, a portion of the machine base being used as a container for the required oil. The work carriage is traversed by hand, a back-gear arrangement giving a slow feed for truing the grinding wheel. This machine may be arranged with either a lineshaft or motor drive. When a motor drive is furnished, the motor is directly connected to the rear drive shaft through a flexible coupling.

GLEASON BEVEL-GEAR TESTING MACHINE

Bevel gears up to 90 inches in diameter can be tested for quietness and proper tooth bearings in a machine recently placed on the market by the Gleason Works, Rochester, N. Y. This machine has a frame that is cast in two pieces which are firmly bolted together and reinforced.

Two spindle heads are mounted on slides, and each slide is adjustable horizontally through a handwheel that is graduated to 0.001 inch and drives through a lead-screw. The heads are secured in place by two clamps, one on each end. The spindles are accurately mounted in the same plane and intersect at an angle of 90 degrees. They are equipped with specially matched ball bearings. An oil pocket at each end of the spindle heads is provided with a sight glass to enable the operator to see at all times whether the bearings are properly lubricated.

The machine is driven by a 10-horsepower motor mounted on the drive head. A friction brake on the driven spindle permits the operator to test the gears under load. The arbors are held in place by draw-bars which are tightened from the rear of the spindles, and a lock is provided for holding the respective spindle when the work or the arbor is to be removed. The steadyrest shown serves as an outboard support for heavy gears. It can be adjusted to take care of any size gear within the capacity of the machine.



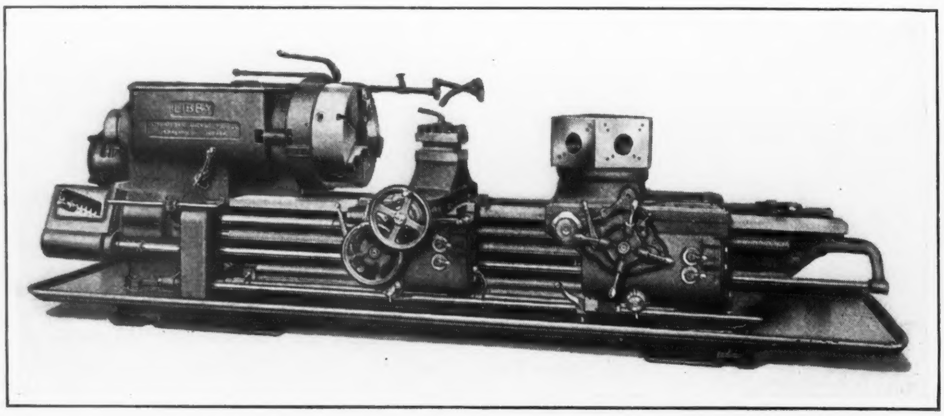
Gleason 90-inch Bevel-gear Testing Machine

"LIBBY-INTERNATIONAL" HEAVY-DUTY TURRET LATHE

A type H heavy-duty turret lathe which may be provided with either an 8 1/4-, 10 1/2- or 12 1/2-inch hole through the spindle is the latest addition to the line built by the International Machine Tool Co., Indianapolis, Ind. The swing over the ways may be either 29 3/4 or 32 inches, and over the carriage, either 27 1/2 or 30 inches. The turret carriage and toolpost carriage have a traverse of 72 inches. Holes up to 23 inches deep can be bored. Sixty-one turret feeds (eight for each change-gear position) ranging from 1/2 to 1/128 inch per spindle revolution are available. There are eight spindle speeds ranging from 8 to 125 revolutions per minute. Threads from 2 to 32 per inch can be cut. The weight of this "Libby-International" turret lathe is about 22,000 pounds.

The bed, headstock housing, oil-pan, legs, and compound reservoir are cast integral. The headstock gearing receives power from a motor connected to the primary drive shaft through a flexible coupling. Driving shafts run in ball or roller bearings, while the main spindle bearings are made of bronze. The chuck gear is fastened to the spindle independently of the chuck. A brake instantly stops the spindle when the drive clutch is released. Lubrication of the headstock is accomplished by a splash system.

A rapid traverse mechanism located in the lower part of the headstock may be used for quickly moving both the toolpost and turret slides in either direction at the rate of 40 feet per minute. This mechanism is driven from the primary drive shaft, and operates independently of all feeds. When the rapid traverse is not in operation, the lead-screws are positively locked. The rapid traverse can be employed during threading operations without losing the lead. The feed-box on the left-hand end of



"Libby-International" Rapid-production Turret Lathe

the machine carries the full set of change-gears required for cutting all standard threads.

Both aprons have eight changes of feed—forward and reverse. The pilot wheel on the turret apron does not rotate when the quick traverse is used. The cross-slide is equipped with an automatic feed trip for each direction, and the power feed can be applied or released instantaneously. There is a reversible cross-feed for the toolpost slide which is independent of the longitudinal feed. When a compound rest is furnished, it has independent power, cross and angular feeds. The turret slide contains an oil reservoir for lubricating the ways. The turret head measures 21 inches across flats, and is clamped to the slide by means of double bevel rings.

Each carriage is provided with dials which register the longitudinal movement of the respective carriage in thousandths of an inch, thus facilitating the duplication of work or the feeding of the carriages accurately to any desired length. Automatic stops which cover a wide range and can be quickly and accurately adjusted are furnished. The bed is supplied with a rack between the ways, which serves as a positive lock for the turret slide in heavy turning operations on work held between centers. This machine requires a 25-horsepower motor running at 1800 revolutions per minute.

PISTOL-GRIP HACKSAW FRAME

A No. 29 hacksaw frame with a special composition vulcanized rubber handle has been placed on the market by the Consolidated Tool Works, Inc., 136 W. 52nd St., New York City. The handle is shaped to give a firm, comfortable grip, thus eliminating hand cramp and insuring complete control. It is adjustable to receive blades from 8 to 12 inches long. All parts are held together, even though the blade is not in place. The blade is tightened by means of a wing-nut located in back where it is out of the way. It may be faced in four directions.

ABRASIVE SURFACE GRINDING MACHINE

A precision surface grinding machine recently brought out by the Abrasive Machine Tool Co., East Providence, R. I., may be provided with a table travel of either 40 or 48 inches and a longitudinal travel of 14 inches. The vertical capacity under a 14- by 1 1/2-inch wheel is 14 inches. The machine weighs approximately 7200 pounds without the driving motor.

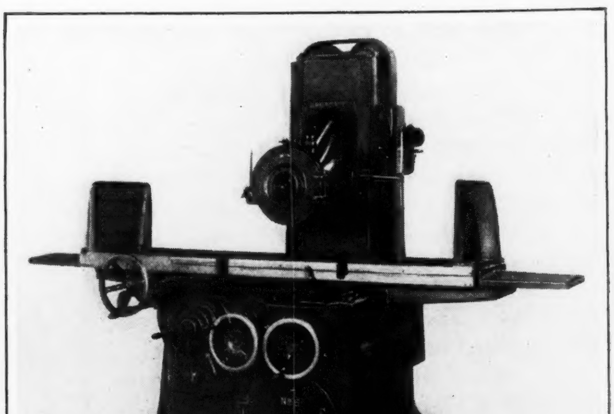
When motor-driven, the motor is located in the cabinet and connected with the main driving shaft by a flexible coupling. The machine will accommodate any standard motor of five horsepower capacity running at 1100 revolutions per minute, but it may also be furnished for a countershaft drive.

The entire feed and reversing mechanism is contained in a transmission case, which can be easily removed for inspection. This case also contains a hydraulic shock absorber which eliminates vibration at the table reversals. The entire mechanism is submerged in a bath of oil. All controlling handwheels are located conveniently and when any of the three automatic feeds are engaged, the handwheels are automatically disengaged.

The wheel-head is provided with an automatic vertical feed for rapid adjustments. The front bearing of the wheel-spindle is carried in an adjustable phosphor-bronze box, and the rear end is carried on a pair of opposed ball bearings furnished with a simple means of adjustment. Lubricant is constantly delivered to the front bearing by means of an impeller on the spindle. It is possible to remove the entire spindle as a unit, including the driving pulley and the ball-bearing housing.

The saddle is carried on two V-ways located at each end of the bed, and is supported directly under the wheel by a flat way. The saddle contains an oil reservoir for lubricating the table and saddle ways by means of rolls.

Standard equipment includes either a wet-grinding or dust-exhaust attachment, but both of these attachments can be installed in the same machine. In cases where direct current is not available for operating magnetic chucks, a small generator is provided. A gravity sight-feed oiling arrangement is located near the top of the column, and connected to bearing points by flexible tubing.



Abrasive Surface Grinding Machine of Improved Design

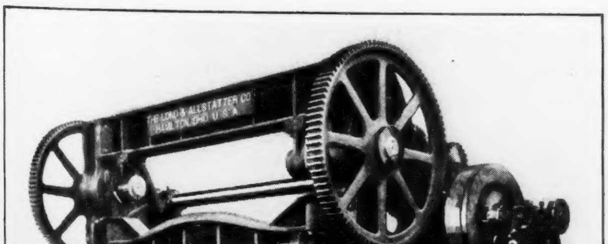
LONG & ALLSTATTER PRESS BRAKES

Open-throat press brakes are now being placed on the market by the Long & Allstatter Co., Hamilton, Ohio, in a range of sizes which handle stock up to 5/8 inch thick extending the full length of the machines. The distance between housings ranges from 6 feet 6 inches to 14 feet 6 inches, and the length of the slide, from 7 feet 4 inches to 15 feet 8 inches. The standard stroke is 3 inches long and the number of strokes per minute is either 30 or 25, depending upon the size of the machine.

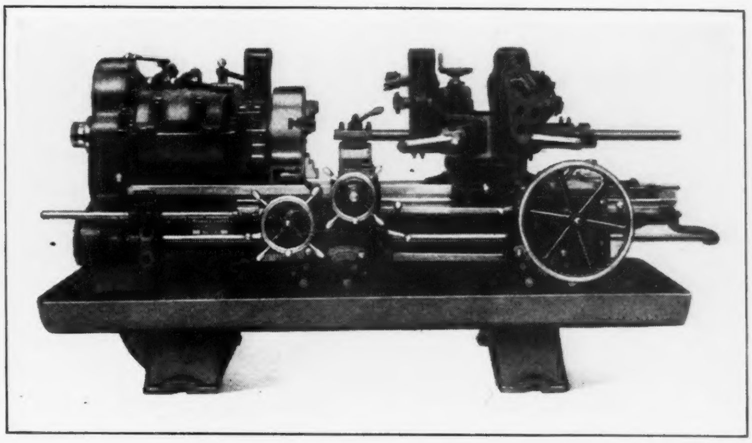
The housings, slide, and base of each press are made of annealed steel castings. An important feature of the brakes is the design of the multiple-disk clutch with which they are provided. The plates of this clutch have asbestos friction linings and operate dry. Low unit pressures are used, so as to give long life to the plates. Adjustments are easily made from the outside through only one medium, which insures uniform pressure all around the plates. The slide can be stopped at any part of the stroke. At the point of release, the clutch automatically applies a large friction brake, which instantly stops the slide.

The flywheel is mounted on Timken tapered roller bearings. All gears are made of steel with machine-cut teeth, and the camshafts are high-carbon hammered steel forgings with the cams integral. The pendulums operate in the upper part of screws which have coarse buttress threads. The pendulums are solid. The slide is adjusted by means of a small motor which delivers power through a roller chain and worm-gearing. A graduated steel scale on the slide indicates the adjustment at all times. Centralized oil or grease lubrication can be arranged for.

The standard drive is through a straight belt from a motor pulley to the flywheel, using a ball-bearing self-adjusting idler. However, a "Texrope" or other type of drive can be furnished. For alternating current, a high-torque squirrel-cage motor should be used, and for direct current, a compound-wound motor.



Long & Allstatter Steel Press Brake



Warner & Swasey Turret Lathe with Chucking Equipment

WARNER & SWASEY TURRET LATHE

A new No. 3-A turret lathe having a 3 1/2-inch bar capacity is being introduced on the market by the Warner & Swasey Co., Cleveland, Ohio. In design, the machine closely follows the 4 1/2-inch turret lathe described in September, 1926, MACHINERY. In the illustration it is shown provided with chucking equipment.

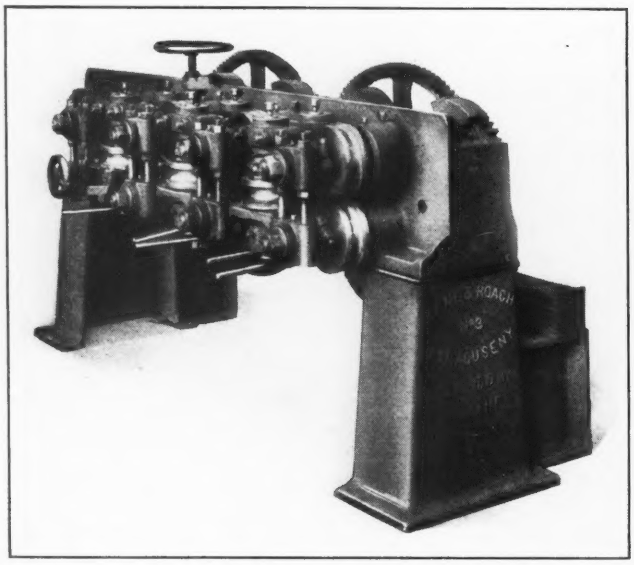
A narrow construction of the all-geared head has been obtained by the use of a short hollow spindle and short gear shafts. These shafts run on adjustable Timken tapered roller bearings and the gears operate in oil. Twelve spindle speeds are provided, forward and reverse speeds being obtained through friction cone clutches.

Patented way covers made of pressed steel completely enclose and protect the bed ways from chips and dirt. The claim is made that on Warner & Swasey turret lathes equipped with way covers, which have been in operation for two years, the original scraper marks are still visible on the vees.

The side carriage is of the Warner & Swasey type, which permits combined cuts to be taken from both turrets. Sixteen longitudinal and cross feeds are available for the side carriage. The hexagon turret carriage is provided with a circumference binder which clamps the turret to the saddle. There are sixteen right- and left-hand longitudinal feeds for the hexagon turret. A power rapid traverse is employed to move this turret quickly back and forth. Both carriages may be fed independently of each other.

KANE & ROACH TUBE SIZING AND STRAIGHTENING ROLL

A tube sizing and straightening roll of the construction shown in the accompanying illustration has just been developed by Kane & Roach, Inc., Syracuse, N. Y. All horizontal roll shafts of this machine are gear-driven, while the vertical roll shafts are idlers. The upper horizontal roll shafts are mounted in an eccentric bearing, thus providing for adjustments, which are advantageous if one run of stock from the mill varies from another or if it should become necessary to regrind the roll. In addition, the last pair of vertical roll shaft sizing rolls is adjustable up and down as well as in and out, which permits them to be used for straightening the tubing. All roll shafts are rigidly tied together with outer bearings.



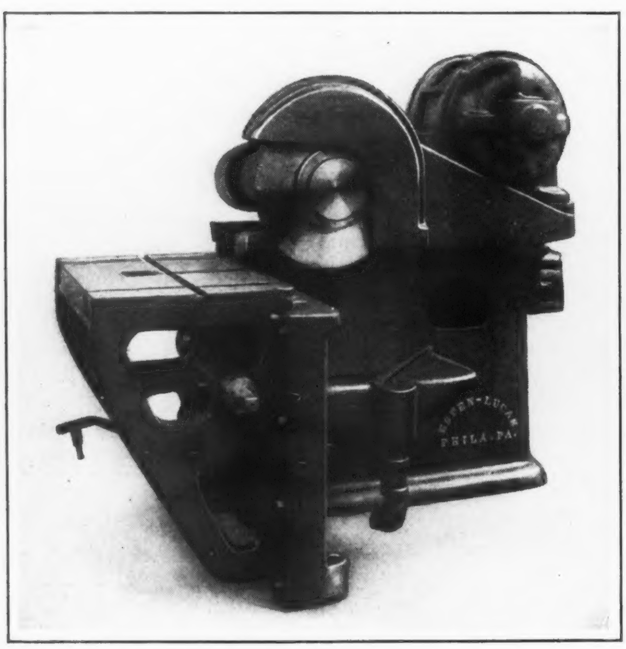
Kane & Roach Tube Sizing and Straightening Roll

Welded tubing of the 1 3/4-inch size is shown lying on the floor. This tubing is received from 0.010 to 0.030 inch over-size and must be delivered to size within plus or minus 0.002 inch. The material averages plus or minus 0.001 inch after being run through the rolls. The machine is arranged for direct connection to a motor, and will deliver tubing at a speed of 75 feet per minute. It is available in several sizes.

ESPEN-LUCAS SEMI-AUTOMATIC SAWING MACHINE

A semi-automatic machine has recently been brought out by the Espen-Lucas Machine Works, Front and Girard Aves., Philadelphia, Pa., for sawing buss bars up to 8 by 3/4 inch, or copper, bronze, and brass bars, tubes, and extruded shapes up to 4 inches in diameter. Small bars and tubes may be held and cut off in multiple. The maximum feed of the machine is 1 inch per one-half second.

The work-table is adjustable vertically to permit holding different sizes and shapes of work at or near the center of the saw arbor. The platen is arranged to permit the attachment of air- or mechanically-operated fixtures, straightedges, etc. Operation of the machine is controlled by means of the foot-treadle at the front left-hand side of the machine. The saw blade feeds automatically forward and makes an automatic quick return. Movement of the saw carriage is accomplished through an Espen-Lucas low-pressure oil feed.

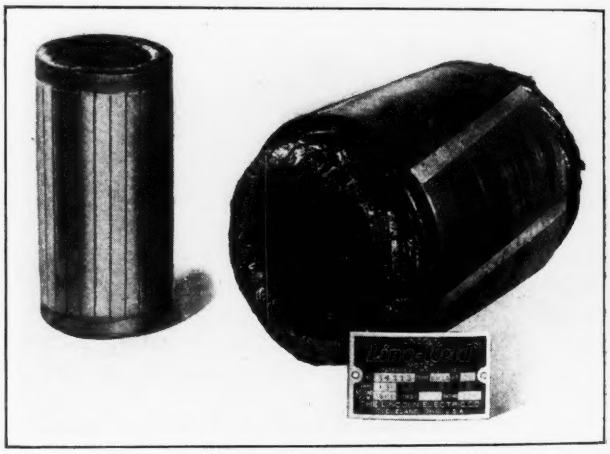


Espen-Lucas Sawing Machine with Hydraulic Saw-carriage Feed

LINCOLN SHELL-TYPE MOTOR

A squirrel-cage motor designed for use in woodworking and other machinery requiring high-speed motors has recently been developed by the Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland, Ohio. This motor is of the shell type, an all-welded design, and is made to the standard dimensions of the trade. It is supplied in two sizes of three- and five-horsepower, respectively. Both sizes are manufactured for either two- or three- phase, 60-cycle current, and run at 3600 revolutions per minute.

The stator is composed of laminated sections, arc-welded together. The welding is done while the shell is under pressure and is placed in six transverse slots. The rotor is also entirely arc-welded, and is provided with either a straight or a tapered bore. The welding does away with the necessity of having a solid shell about the laminations and replaces the conventional rivets. It is pointed out that because of this, the amount of active field is kept at a maximum, that the effect is to increase the magnetic flux and allow more copper to be used in the slots, and that this increase of copper makes for a cooler running motor and permits greater overload.



Rotor and Stator of New All-welded Lincoln Motor

HOBART ELECTRICAL TEST BENCHES

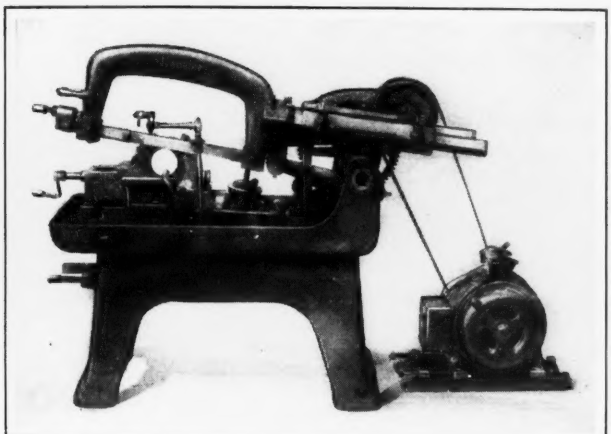
Two new sizes of 1 1/4- and 2-horsepower rating, respectively, have been added to the line of electrical test benches made by the Hobart Bros. Co., Troy, N. Y. These benches have the identical features of the 1 1/2-horsepower unit manufactured by the same company, differing only in the rated capacity of the motors. The 1 1/4-horsepower bench will handle all electrical tests necessary in the average shop. It shows ignition, starting, and lighting troubles.

"RAPIDOR" SAWING MACHINE

As many as 200 strokes per minute can be made with a "Rapidor" heavy-duty sawing machine recently produced by Edward G. Herbert, Ltd., Atlas Works, Chapel St., Levenshulme, Manchester, England. This machine has been designed with a view to obtaining maximum output from high-speed steel saw blades.

Equipped with a "Rapidor" 18 per cent tungsten high-speed steel blade and run at the maximum speed, the machine has cut off 3-inch diameter mild steel bars in an average time of 3 minutes 20 seconds per cut, the shortest time being 2 minutes 9 seconds. Saw blades of the kind mentioned are manufactured by the same concern, as described in December, 1923, MACHINERY. They can be resharpened many times until the original teeth have been completely ground away.

In the new machine, tension is exerted on the saw blade by turning a handle, a patented indicator showing when the correct tension has been obtained. All operations are controlled from one position in front of the machine, and all working adjustments are made from the same position. On



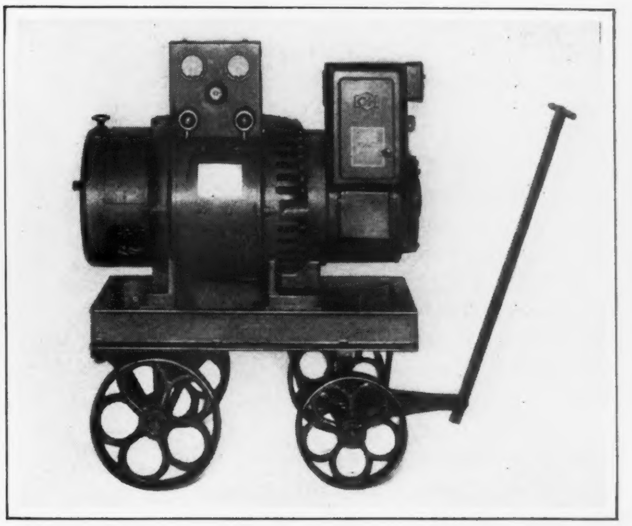
"Rapidor" High-speed Metal Sawing Machine

the three-speed machine, speed changes are obtained by turning a handle.

The machine is built in two sizes, with capacities of 6 by 6 inches and 8 by 8 inches, respectively, but larger sizes are to be brought out shortly. It may be arranged with a single-speed belt drive, a three-speed belt drive, a single-speed motor drive, a three-speed motor drive with constant-speed motor, or a variable-speed direct-current motor drive.

"FUZON" MOTOR-DRIVEN ARC WELDER

The latest addition to the "Fuzon" line of arc welders made by the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill., is a direct-current machine operated by a three-phase alternating-current motor using 220- or 440-volt current. Both the welding generator and motor are mounted on the same shaft, giving a two-bearing unit. The arc produced with this equipment is said to possess unusual stability and respond so quickly to changes in length that it introduces a new arc quality which is best described by the term "flexibility." It is possible to instantly increase or decrease the arc length by half an inch without extinguishing it.

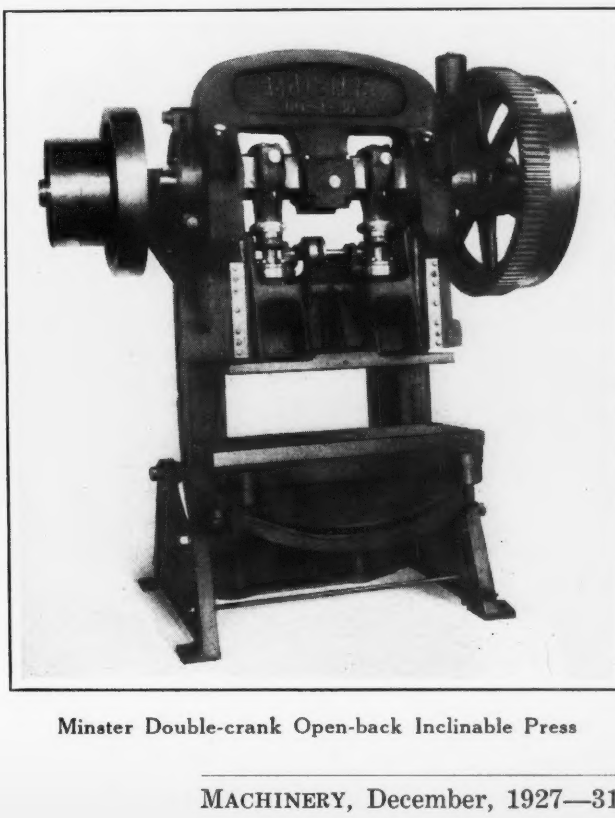


"Fuzon" Arc Welder with Motor and Generator on One Shaft

This flexibility of arc is said to be due to the elimination of such auxiliary apparatus as an external stabilizer, field rheostat, and separate exciter. It is mentioned that a man who has never attempted welding before can completely melt an electrode without once breaking the arc. One control, a simple brush shifting device, governs the welding current. The current can be varied from 50 to 300 amperes. Metals from the thinnest to the thickest can thus be welded with equal facility.

MINSTER DOUBLE-CRANK OPEN-BACK INCLINABLE PRESSES

A double-crank open-back inclinable press designed for a large variety of operations and continuous production was recently placed on the market in three sizes by The Minster Machine Co., Minster, Ohio. Owing to its wide range, this press is of particular value in shops where single-purpose presses cannot be installed because of limited space. The three presses have a ram pressure of



Minster Double-crank Open-back Inclinable Press

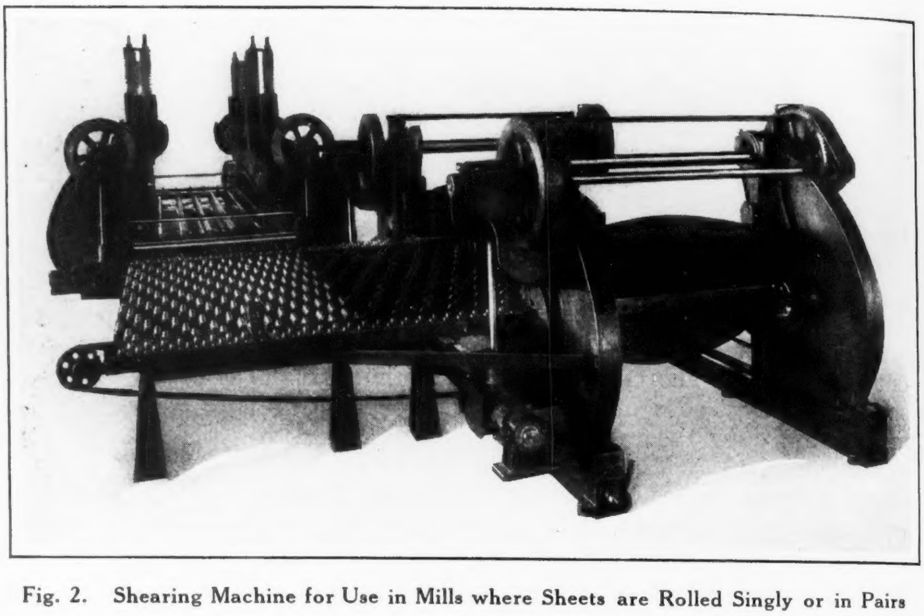


Fig. 2. Shearing Machine for Use in Mills where Sheets are Rolled Singly or in Pairs

32, 45, and 56 tons, respectively, while their weights range from 5300 to 13,000 pounds.

Either a flywheel or back-gear drive can be provided for either size. The presses are equipped with the jaw or block clutch. The clutch collar is made of a hammered steel forging and the striking block inserts are made of alloy tool steel.

The deep gap and the wide opening in the frame of the presses facilitate feeding work from right to left or from front to back. The frame may be raised or lowered by means of two telescoping screws which are connected by bevel gears. The supporting trunnions on the frame are so located that when the press is inclined, the height from the floor to the center of the dies does not change materially. All frame castings are made of semi-steel and parts subject to heavy strains are reinforced. Lugs cast on the frame permit the use of steel tie-rods to increase the rigidity of this member when the work demands it. The crankshaft is made of a high-carbon hammered steel forging.

The slide is of flanged design and operates on long accurate ways. It is supported in heavy long gibs that minimize wear and the adjustments necessitated by wear. Adjustment of the slide is accomplished through two sets of bevel gears and pinions which are operated by a ratchet mechanism.

STREINE CONTINUOUS AUTOMATIC SHEARS

The two continuous automatic shearing machines here illustrated have recently been placed on the market by the Streine Tool & Mfg. Co., New Bremen, Ohio, for use in sheet and tin plate mills. The machine shown in Fig. 1 is designed for use in mills where the material is rolled and sheared in packs. It requires only two operators, and is capable of handling seven or eight tin packs per minute, or approximately 10 tons of material per hour.

The packs are fed lengthwise with the curl end first between caterpillar conveyors equipped with pressure pads, these conveyors forming an integral part of the machine and transporting the packs into the side-cutting shears. As each pack reaches the proper position, the conveyors automatically stop and the shears automatically trim both sides of the pack to any desired width. The conveyors then again start and carry the pack to the end-cutting shears. An electric switch located on the shear bed controls the cutting off of the curl or front end. This switch is adjustable to provide for cutting off any amount of stock ranging from 1/2 to several inches.

After the curl end is cut off, the switch remains disengaged while the pack passes to the back gage. Here the conveyors are again stopped and the end-cutting shear cuts up the pack into the desired sizes. While this operation is in progress, another pack is entered into the side-cutting shears, thus giving a continuous operation.

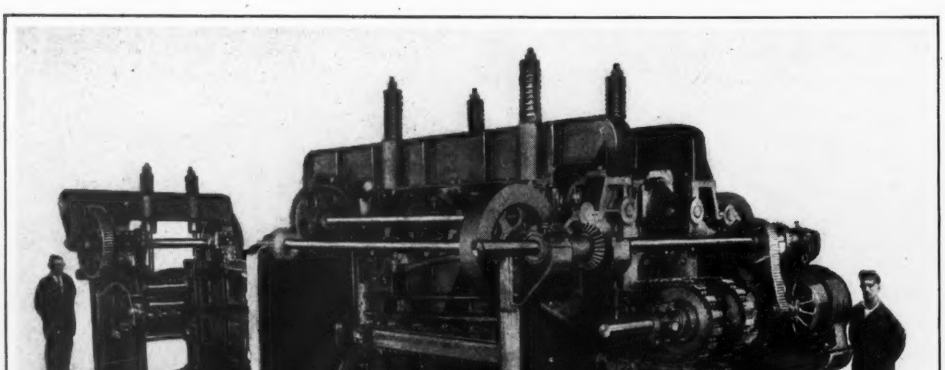
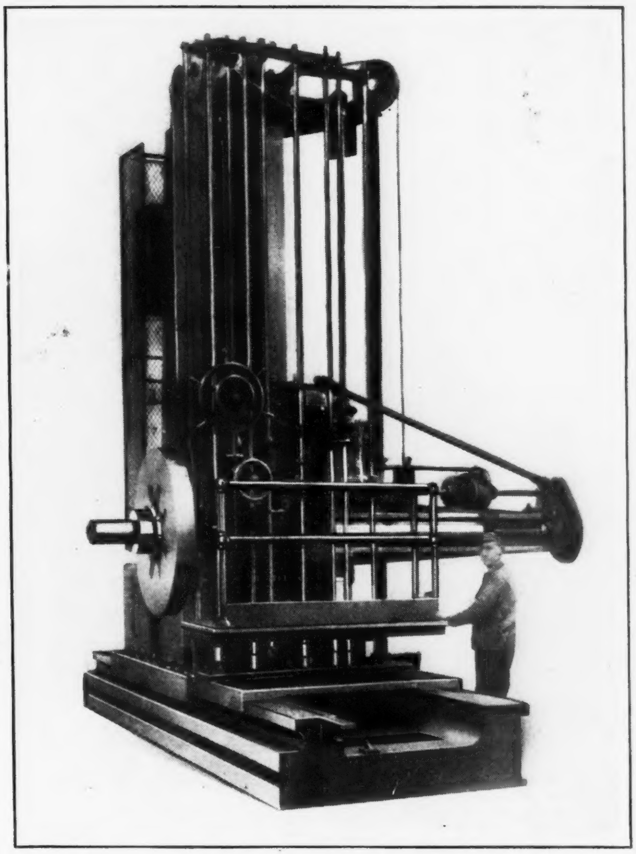


Fig. 1. Streine Continuous Automatic Shearing Machine

Fig. 2 illustrates a shearing machine for use in mills where sheets are rolled singly or in pairs. Instead of the sheets passing between two conveyors having pressure pads, they move on top of a roller conveyor to the side shears. After the sides are trimmed, the sheets are moved on to a finishing table which transports them to the end-cutting shears.

NILES HORIZONTAL BORING, DRILLING AND MILLING MACHINES

The horizontal boring, drilling, and milling machines built by the Niles Tool Works Co. Division of the Niles-Bement-Pond Co., 111 Broadway, New York City, have been entirely redesigned. New features include a totally enclosed saddle and drive box, both of which are provided with an automatic lubricating system to all important gears, shafts, and bearings; steel drive and feed gears throughout; a screw feed to the spindle; a power rapid traverse to the spindle by a separate motor; a more convenient and centralized grouping of controls; and graduated scales on the column face and bed ways to facilitate measuring the vertical travel of the saddle and the horizontal travel of the column. Machines of this line are built in sizes having spindle diameters of 6, 7, 8, and 10 inches, the machine illustrated having a spindle 7 inches in diameter with a traverse of 72 inches.


Niles Improved Horizontal Boring, Drilling, and Milling Machine

Power spindle feeds are provided for drilling and boring operations, the feeds being reversible. For drilling and other operations requiring relatively high speeds, the spindle is driven through its sleeve, whereas for boring to large diameters and for milling operations, the drive is obtained through a faceplate gear and pinion. Hand traverse and a fine hand feed are provided. The power traverse is derived from a one-horsepower motor mounted at the outer end of the saddle and connected to the spindle feed-screw through gearing. The saddle and column are also provided with reversible power feeds, rapid traverse, and a fine hand adjustment.

The machine is driven by a 15-horsepower motor mounted on the gear-box at the rear of the column. Either a direct-current variable-speed motor drive or an alternating-current constant-speed motor drive through the gear-box can be supplied. The central lubricating system of this box is driven by a pump connected to a 1/4-horsepower motor. A similar arrangement drives the lubricating system of the saddle.

All operating levers for the saddle and column are mounted on the saddle and controlled from a platform attached to that member. A floor plate, which is bolted to the side of the bed and held in alignment by means of a planed tongue, may be furnished with the machine. An outboard column may be supplied, either plain or mounted on a sub-base. Circular tables equipped with either a hand or power rotary feed may also be furnished.

BROWN & SHARPE PEN ATTACHMENT

The Brown & Sharpe Mfg. Co., Providence, R. I., has brought out a new pen attachment for use with the B & S universal divider No. 843 (new design), and the steel beam trammels No. 845 (with a 14-inch beam). The knurled handle from a tram can be screwed in a tapped hole in the pen attachment. This attachment enables draftsmen to draw circles, arcs, fillets, etc., accurately.

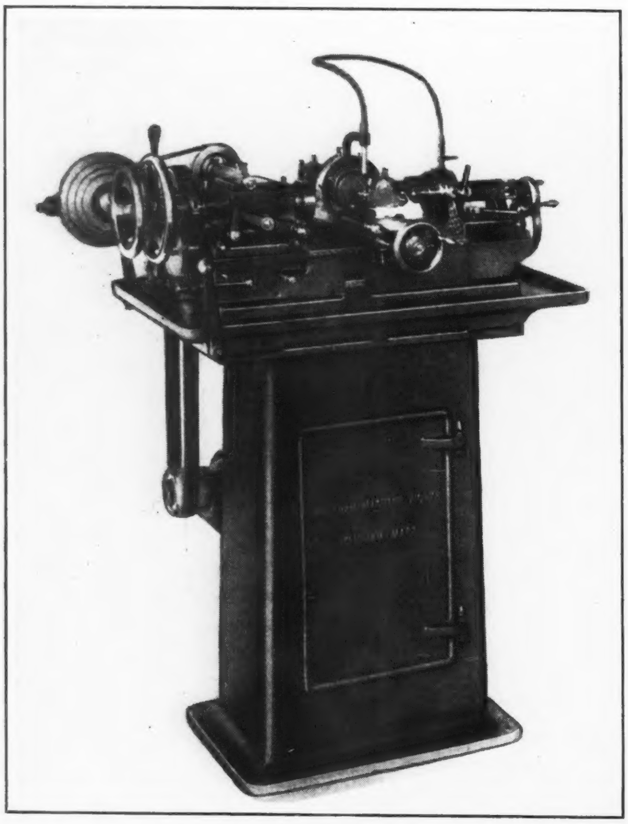
WALTHAM IMPROVED THREAD MILLER

A new model of the thread miller built by the Waltham Machine Works, Newton St., Waltham, Mass., is being introduced to the trade. The new model may be mounted on a cabinet base and equipped with an independent motor drive, as illustrated, or it can be furnished as a bench machine and driven by a wall countershaft. It is made in one length only, which is intermediate between the two lengths of the earlier machines. The machine is best adapted to handling work 2 inches or smaller in diameter. When work is held between centers, the maximum length of thread that can be cut is 8 3/4 inches, but when one end is held in the spring chuck, threads up to 10 inches long can be cut. The extreme distance between centers is 12 inches.

The cutter-head can be adjusted to any angle up to 35 degrees in either direction instead of only to 25 degrees as heretofore. It may be swiveled horizontally as well as vertically. Oil and chips are carried away from the outside of the cross-slide instead of being carried down through a pipe as before. This new method allows the use of a much greater supply of oil.

The general features of the earlier machines have been retained, and provision has been made for the use of a variety of special equipment. The mechanism for relieving taps and multiple threading cutters is of new design. There is also a special cutter-head for external and internal milling operations, and another which is used for helix angles of 40 degrees or more. Special tailstocks are also available.

When the work is of such nature that only a short movement of the carriage is necessary and the work is required in considerable quantities, the machine may be equipped with a camshaft instead of the lead-screw. This makes the machine more nearly automatic. For some kinds of work it is also possible, by using suitable gearing, to index



Waltham New Model Thread Miller with Cabinet Base

the work for multiple threads. Two kinds of taper attachments can be furnished, a "plain taper bar" attachment and a "compound taper bar" attachment. The weight of the bench machine with standard equipment, including change-gears, is 390 pounds. The weight of the cabinet base, adapter plate, and adjustable angle plate for the motor is 270 pounds.

LINCOLN AUTOMATIC TANK-HEAD WELDER

A "Stable-Arc" carbon-arc automatic welding machine has just been developed by the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio, primarily for welding the heads in range boilers. The boiler or tank is mounted on a rotating table in an inclined position, as shown in the illustration. The table is driven by a small variable-speed motor which provides speed adjustment for

Lincoln Automatic Machine for Welding Heads in Tanks

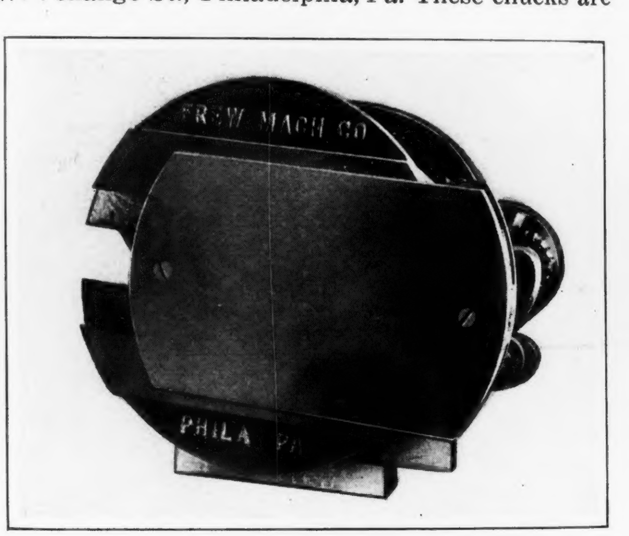
tanks of various diameters. Roller rests maintain the alignment of the work. The carbon electrode is carried by an adjustable arm.

Filler metal is not required in this operation, the head being flanged and inserted so that a lap joint is obtained, as in a riveted tank. The heat of the arc melts the lap weld edge of the cylindrical sheets, fusing it with the head and forming a leakproof joint. On No. 14 gage material, seams have been welded at the rate of 135 feet per hour.

This machine is applicable to welding all kinds of small cylindrical tanks. It is one of three automatic machines used for this class of work, the other two being carbon-arc automatic machines for making the longitudinal seam and welding the bottom.

FREW OVAL OR ELLIPTICAL CHUCK

Three sizes of an oval or elliptic chuck designed for attachment to engine lathes are being introduced on the market by the Frew Machine Co., 132 W. Venango St., Philadelphia, Pa. These chucks are



Frew Oval or Elliptic Chuck for Engine Lathes

intended for use in turning punches, dies, and similar work. The maximum capacity of the 12-inch chuck is a 5 1/2- by 8 1/2-inch ellipse; of the 16-inch chuck, an 8- by 12-inch ellipse; and of the 18-inch chuck, a 10- by 16-inch ellipse.

The chuck is set for the required ratio between the two diameters of the ellipse by sliding a block, tongued to a stationary piece, into the proper position. The slide block is then bolted in place. The chuck is easily applied to any lathe having a swing not less than that of the chuck, one part being screwed on the end of the spindle and the stationary part bolted to the front of the headstock. Work can be strapped to the faceplate or a chuck can be mounted on the faceplate for holding the work.

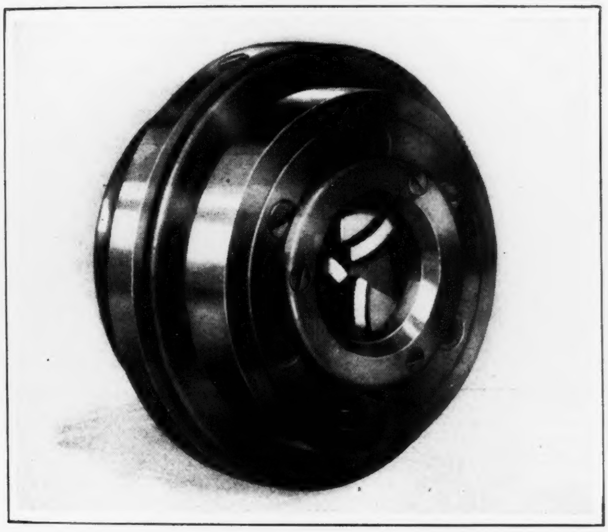
McCROSKY IMPROVED FACEPLATE

An improved "Neva-Stop" faceplate recently brought out by the McCrosky Tool Corporation, Meadville, Pa., has three driving jaws instead of two, as in the case of the earlier model. The three jaws give a surer and a better distributed drive. With the improved faceplate, a lathe operator can change work held between centers without stop-

ping the machine, the same as in the previous design.

The faceplate is screwed on a lathe spindle and work is gripped and driven by the three jaws, which are serrated as seen in the illustration. These jaws are brought into contact with the work by springs, but the driving pressure is obtained through the cam action of the jaws. To release the work, the operator merely applies a slight resistance to the outside collar, causing the jaws to open automatically and lock in the open position. With the spindle turning, a new piece is then placed on the centers, after which the operator touches a trip located in the collar, thus instantly releasing the jaws and causing them to drive the work.

A plain wide collar can be furnished in place of the collar equipped with the trip, for operating the faceplate by means of a simple friction brake. The brake is applied by the operator stepping on a treadle, which produces the necessary friction on the collar to open the jaws and hold them open. This arrangement is particularly recommended when one operator is in charge of more than one machine.



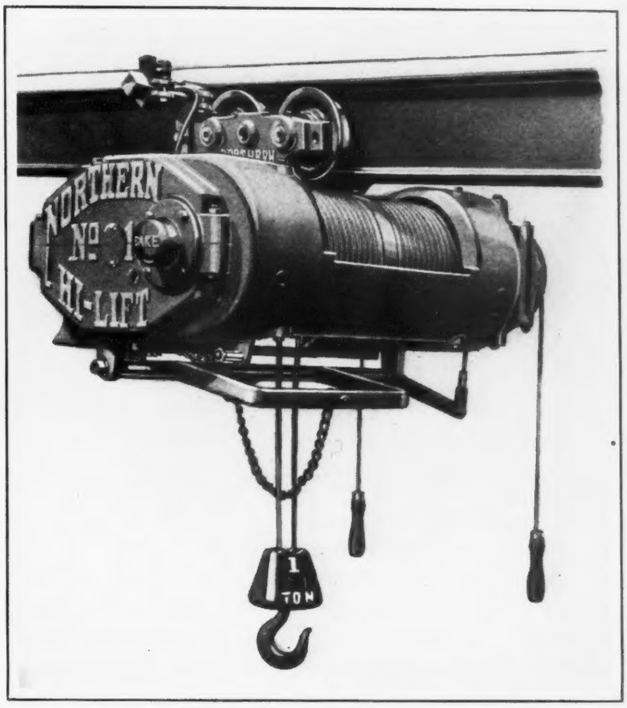
McCrosky "Neva-Stop" Faceplate of Improved Design

This "Neva-Stop" faceplate is furnished with two sets of jaws which handle work from 3/8 to 2 1/2 inches in diameter, but jaws for holding work of larger diameter can also be supplied.

NORTHERN "HI-LIFT" HOISTS

A new series of "Hi-Lift" electric hoists now being placed on the market by the Northern Engineering Works, Detroit, Mich., are patterned after the "Standart-ized" type LE trolley manufactured by the same concern. A feature pointed out for these hoists is their ability to lift the load hook until its center is within 14 inches of the under side of the beam. The hoists have a plain I-beam trolley and corner collectors. They are provided with a motor check brake which is attached to the end of the motor armature shaft, and a mechanical brake which is located in the hoisting gear train.

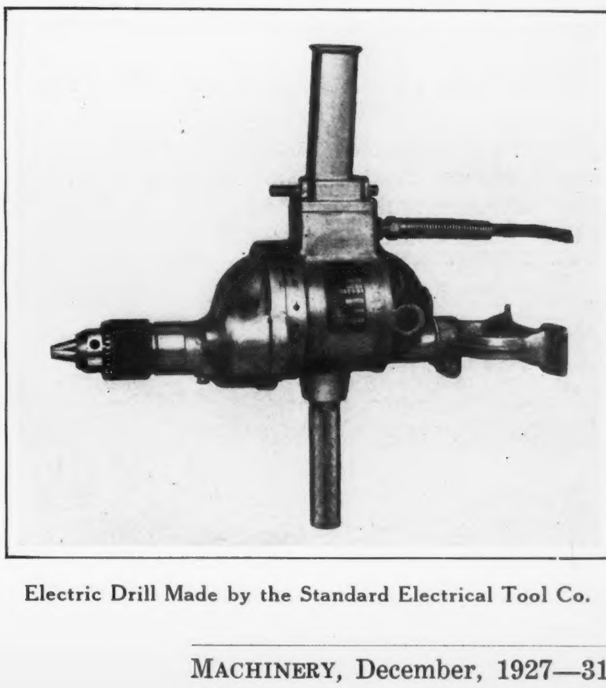
Another feature is the one-piece frame casting. The rope drum and frame casting are so arranged that the shroud fits over the ends of the drum. This improves the appearance of the equipment and eliminates the possibility of the hoisting rope going over the ends of the drum. Each hoist is suspended by a cast-steel hanger piece. Stops prevent the load hook from going too high, unwinding the rope, and starting it up on the wrong side of the drum.



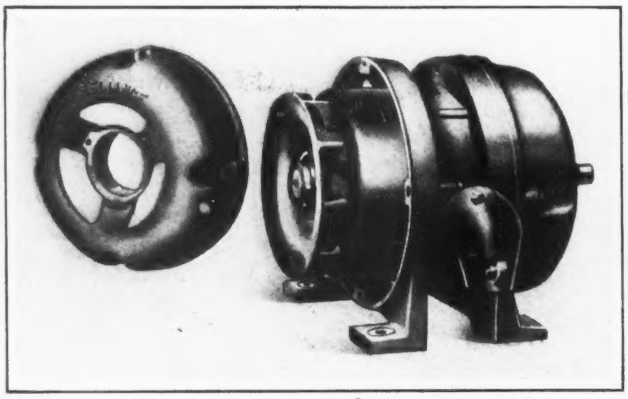
New Series "Hi-Lift" Electric Hoist

UNIVERSAL-MOTOR PORTABLE ELECTRIC DRILL

A 1/2-inch portable electric drill recently brought out by the Standard Electrical Tool Co., 1938-46 W. Eighth St., Cincinnati, Ohio, has a capacity for drilling up to 1/2-inch holes in steel and 1-inch holes in hard wood. The motor is manufactured by the General Electric Co. and will operate on either direct or alternating current. S K F ball bearings are provided, while the gears are made of chrome-nickel steel and hardened. The switch is of 10-ampere capacity. The motor housing is made entirely of aluminum, the weight of the drill being only 14 pounds.



Electric Drill Made by the Standard Electrical Tool Co.



Reliance Fan-cooled Motor with Bearing Bracket Removed

RELIANCE FAN-COOLED INDUCTION MOTORS

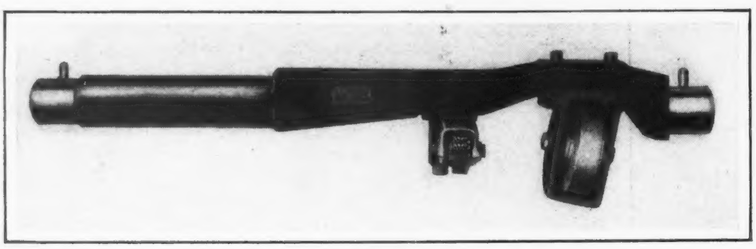
Fully enclosed fan-cooled induction motors designed for use under conditions where there is considerable dirt, iron dust, or moisture, have been placed on the market by the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. These type AA motors are built in various sizes ranging in capacity from 1 1/2 to 10 horsepower. In the design, excess weight and size have been overcome by the use of principles of ventilation and enclosure which make it possible in most cases to obtain the full open rating from a fully enclosed motor.

Internal fans circulate air around the coil heads where a large part of the heat is generated. This causes the internal heat to be transmitted to radiating bonnets which entirely surround the coil heads and seal the motor against the entrance of dirt. Across the outside surface of these radiating bonnets, a strong blast of air is blown, which absorbs the heat from the bonnets and carries it away from the motor. This cooling air also passes across the outside of the stator core.

The outside blast of air is produced by large radial fans, one at each end of the motor shaft just outside the bonnet, as may be seen in the illustration. These external fans are protected by a bearing bracket such as is used on an ordinary induction motor. The external appearance, mounting, and limiting dimensions of these motors are the same as those of standard induction motors of the same frame size.

ROSS WHEEL-TRUING UNIT FOR CRANKPIN GRINDERS

Economy and speed of operation without sacrifice of finish are claimed as advantages of a wheel-truing device recently introduced to the trade by the Ross Mfg. Co., Cleveland, Ohio, for application to Landis 16-inch hydraulic crankshaft pin grinders. The unit consists of a bar which fits into the pot chucks of the grinder and takes both a metal-disk ball-bearing roughing tool and an abrasive-wheel finishing or master tool. Both dressers may be bolted to the bar at one time, as shown, or each may be used alone.

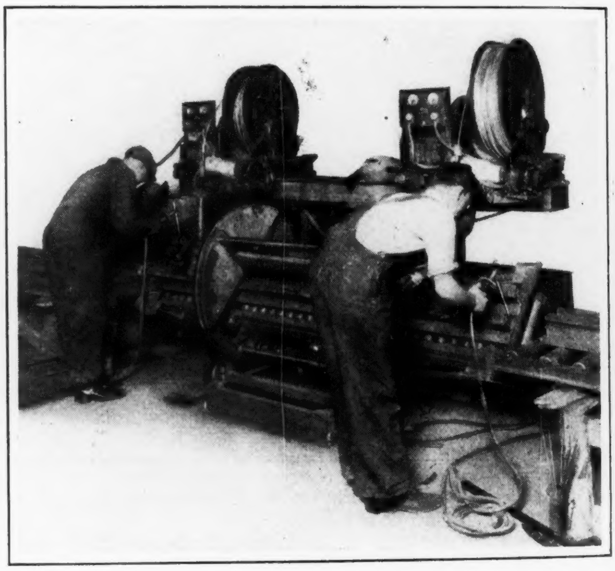


Ross Wheel-truing Device with Roughing and Finishing Tools

The finishing tool or wheel may be traversed at a relatively fast rate across the grinding wheel, and deep cuts may be taken into a loaded grinding-wheel surface without harm to the dresser. The roughing tool may be used preliminary to finish-truing or exclusively for certain wheels requiring a radius of not less than 3/32 inch. Equipped complete with the master tool, the unit weighs only about 35 pounds, which is considerably less than the weight of the average crankshaft. A pin is provided in each end of the bar to insure correct alignment of the unit in grinding machines.

WELDER FOR METAL RAILROAD TIES

Automatic welding equipment for making metal railroad ties from scrap rails has been brought out by the General Electric Co., Schenectady, N. Y.



General Electric Automatic Machine for Arc-welding Metal Railroad Ties

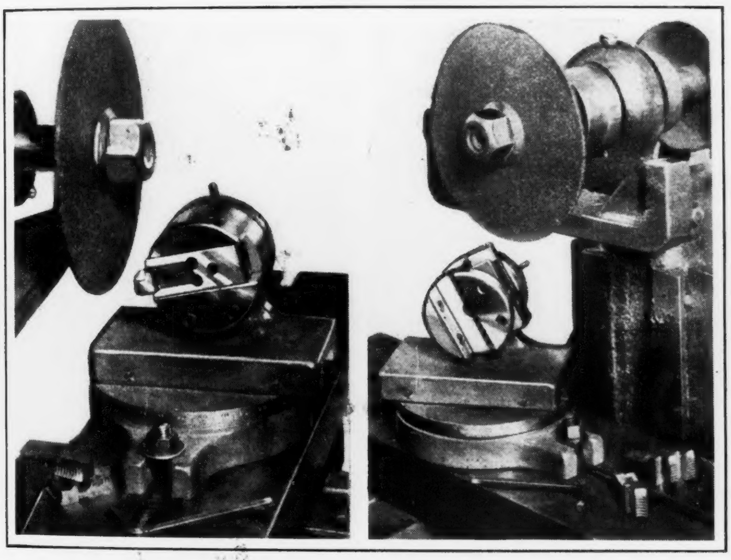
Each metal tie consists of two lengths of worn or scrap rail, cut to length and held together at both ends by angle-iron bars that are welded to the rails. The rails are further held together by two tie-plates which are welded to the top or head of the rails at the point where the track work is clamped to the tie. The tracks are clamped to the tie-plates by means of rail clamps and spring-steel keys.

The new welding apparatus consists of an automatic tie welding machine and a 1500-ampere motor-generator set with two circuits for hand welding and two circuits for automatic welding. There is a section of roller-conveyor on which the rails are moved into position for welding. A jig insures correct spacing of the rails and locates the tie-plates on top of them. Two pneumatic plungers hold the parts rigidly for the operation. There is a pair of spring and toggle-operated clamps which hold the angle-irons against the rail ends.

A mechanism rotates the entire jig with the rails and the plates. This mechanism turns a distance of 45 degrees in either direction from the perpendicular and permits automatic welding, first on one side of the tie-plate and then on the other. Two automatic welders mounted on individual traveling carriages weld the tie-plates simultaneously. For maximum production, the machine requires two operators, one for each head. Separate control panels are furnished for the heads, thus making the operators largely independent of each other. The estimated output with two operators is one tie every five minutes.

"NAMCO" CHASER GRINDING FIXTURE

A fixture designed for grinding uniformly and accurately the chasers used in "Namco" thread-cutting tools is being placed on the market by the National Acme Co., Cleveland, Ohio. In the left-hand view of the accompanying illustration, this fixture is shown being used for grinding the cutting face of a chaser, and in the right-hand view, for grinding the chaser throat or chamfer.



Methods of Using the "Namco" Grinding Fixture for Chasers

Five adapters, which can be easily interchanged, are furnished with each fixture to take care of the entire range of chasers used in "Namco" self-opening die-heads. The fixture is easily fastened to the table of any grinding equipment. The indexing plate is adjustable to 90 degrees in each direction. The holder for the adapters is also adjustable and is graduated for the various angles which may be required in grinding the chaser throat or chamfer.

A noteworthy feature of the fixture is that both the chaser face and throat are ground with the use of only one wheel. Detailed charts which accompany each fixture give the proper angle for grinding the chaser face and throat or chamfer for various materials to be threaded; proper cutting speeds; the lubricant recommended for thread cutting operations; and the different wheels for various sizes of chasers.

Husky Wrench Set for Small Bolts and Nuts

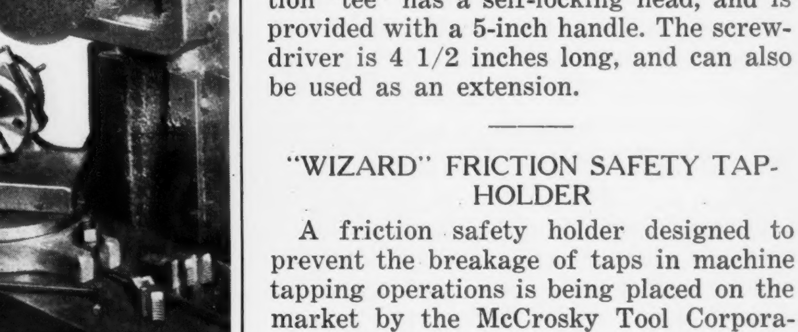
HUSKY WRENCH SET

A No. 999 "Husky Baby" set of wrenches for small bolts and nuts on carburetors, magnetos, generators, speedometers, etc., is being placed on the market by the Husky Wrench Co., Milwaukee, Wis. It includes 5/32-, 3/16-, 1/4-, 5/16-, 11/32-, 3/8- and 7/16-inch hexagonal sockets and 1/4- and 5/16-inch square sockets. All sockets are stamped with the size of wrench opening. The two square sockets can also be used for holding small taps with square shanks. The combination "tee" has a self-locking head, and is provided with a 5-inch handle. The screwdriver is 4 1/2 inches long, and can also be used as an extension.

"WIZARD" FRICTION SAFETY TAP-HOLDER

A friction safety holder designed to prevent the breakage of taps in machine tapping operations is being placed on the market by the McCrosky Tool Corporation, Meadville, Pa. This holder fits directly into the spindle of a drilling machine, the turret of a turret lathe, the tailstock of an engine lathe, or the spindle of an electric drill. It enables an operator to drive a tap to its full capacity, and when the tap meets an obstruction or hits the bottom of a blind hole, a friction member slips and the tap stops.

There are only five parts in the holder, including a bushing that holds the tap. A plug which receives the bushing is tapered both ways, and each taper fits into a fiber lined cup. The knurled collar is a differential nut which draws the lower cup toward the upper to increase the friction.



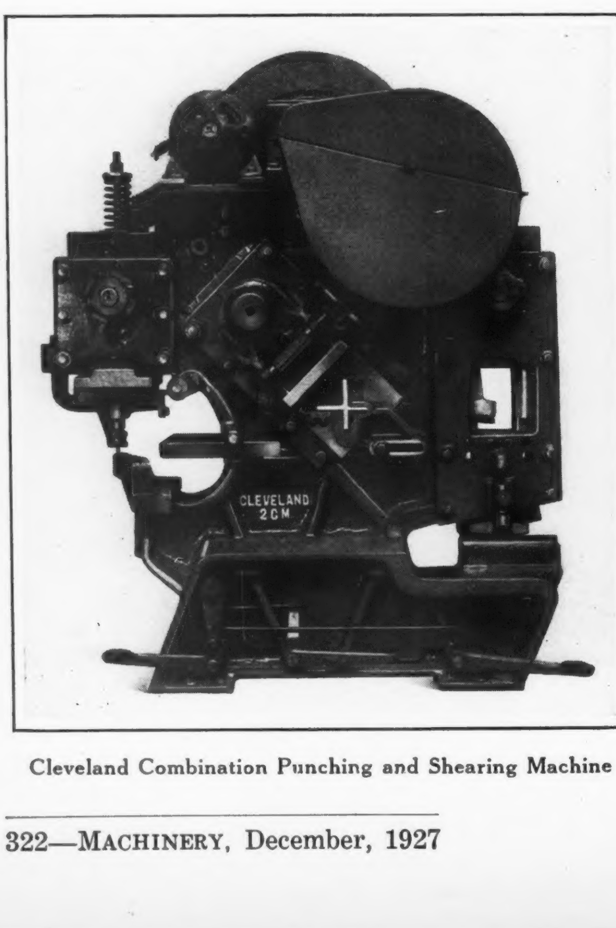
"Wizard" Safety Tap-holder and Extra Bushings

The tap is driven by the square end. The bushing is driven by the two keys and floats in the holder, being held in place by a ball and spring retainer. If the spindle is raised too rapidly in taking out a tap, the bushing will be drawn out of the holder without injury to the tap. Three different sizes of holders and bushings are manufactured to handle standard hand taps from 3/16 to 1 1/4 inches, and pipe taps from 1/8 to 1 inch. Special bushings can be furnished for taps having special shanks and for setting nuts.

CLEVELAND COMBINATION PUNCHING AND SHEARING MACHINE

Three men can work simultaneously and control each operation separately on a No. 2 combination punching and shearing machine recently placed on the market by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. The machine may be used for punching, notching, shearing, and splitting operations on structural shapes and plates. I-beams from 4 to 15 inches, inclusive, may be punched in either the flanges or web, and holes up to 1 1/16 inches can be punched through 5/8-inch plate. I-beams up to 6 inches, channel irons up to 8 inches, and angle-irons up to 2 by 2 by 1/4 inch can be notched. I-beams up to 6 inches, channel irons up to 9 inches, and angle-irons up to 4 by 4 by 1/2 inch can be sheared. Plates up to 5/8 inch thick can be split.

Among the features claimed for this machine, some of which are patented, are included a solid steel-casting frame, a floating punching attachment, a die-block which permits punching minimum and maximum sized sections in webs and flanges without requiring changes, dual stripper lugs which meet any stripping condition, an interchangeable triple gag attachment, an extended lower splitting shear blade which furnishes a support for the material when starting a cut, an internal notching attachment for rectangular and 45-degree notches, automatic lubrication to the flywheel shaft, and a bar twisting attachment.



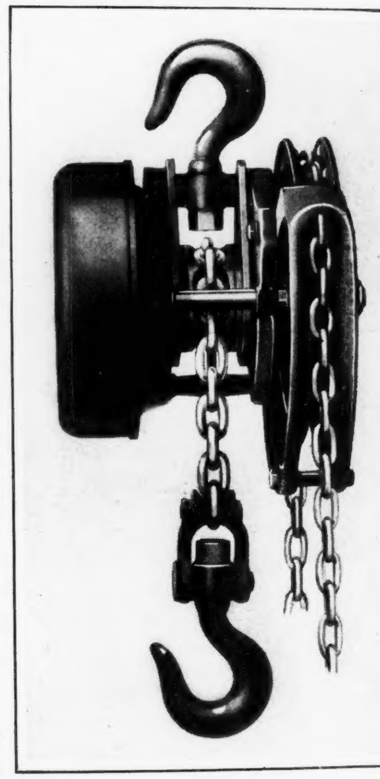
Cleveland Combination Punching and Shearing Machine

It is also pointed out that the distance from the face of the block to the center of the die may be changed without removing punch blocks. Punches may be placed either parallel or at right angles to the main shaft on the triple gag. The punching, splitting, and angle cutting units are operated individually by four-jaw clutches which run in oil.

DICKERMAN SPUR-GEARED HOISTS

A line of "Ideal" spur-geared chain hoists is being introduced to the trade by the Dickerman Hoist Mfg. Co., 872 E. 72nd St., Cleveland, Ohio, in sizes ranging from 1/4 to 40 tons capacity. These hoists are of the planetary type and are equipped with ball bearings.

In each hoist, an endless operating chain passes over a handwheel which turns on the screw hub of a ratchet friction disk, keyed to a one-piece drive shaft and pinion. The pinion meshes with two gears held diametrically opposite each other in a cage secured to the wheel that carries the load chain. Integral with these gears are intermediate pinions which mesh with a large internal gear and serve as a fulcrum for the planetary gear.


Dickerman Spur-geared Hoist

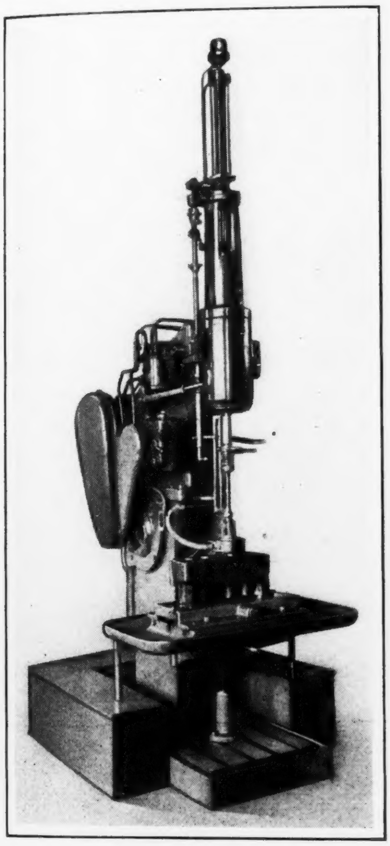
A pull on either side of the hand chain loop causes the drive pinion to rotate the gears in opposite directions, and the pinions on the gears to travel around the internal gear, revolving the cage and load wheel and thereby raising or lowering the load. When the pull on the hoisting side of the hand chain loop is discontinued, a pawl engages the ratchet disk and prevents the load from descending. Hoists having capacities of over 10 tons are made with two gear trains contained in separate cases, which are connected by a yoke. The two gear trains are operated by separate hand chains, but there is only one hoisting hook.

BARNES DRILL CO.'S HONING MACHINE

The No. 249 single-spindle cylinder honing machine introduced at the recent Cleveland Show by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill., incorporates various improvements over the No. 212 machine described in June MACHINERY.

One of the important improvements is that either four or eight quick changes of speed can be provided. The machine may also be arranged with only one speed.

Another new feature is that the Oilgear pump is built into the head of the machine and driven from the same motor shaft that drives the machine itself. Power is delivered to the machine and pump through separate silent chains which are guarded, as shown. By mounting the motor within the column, floor space is saved.



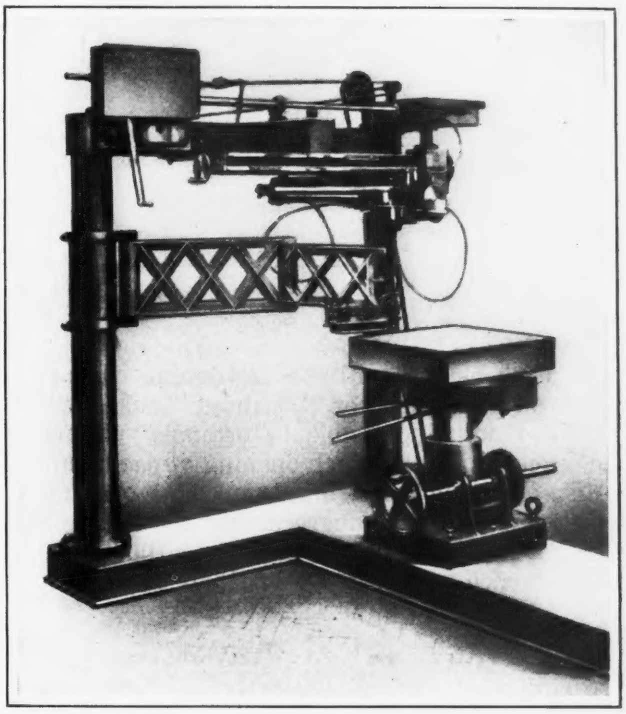
Barnes Drill Co.'s Improved Single-spindle Honing Machine

The spindle, which reciprocates for the operation, is hydraulically controlled as to length of stroke. The hydraulic cylinder is superimposed directly over the spindle, and permits any vertical spindle travel up to 16 inches. Attachment of the piston to the spindle is obtained by means of a ball-bearing coupling. The table does not reciprocate. An air-operated table can be furnished when the 16-inch vertical spindle travel is not sufficient to lift the hone out of the work. The regular table has a hand-operated raising screw. Work-holding fixtures and other accessories can be supplied.

A five-horsepower motor is recommended for honing cylinders up to 4 inches in diameter and a 7 1/2-horsepower motor for larger cylinders. With a pulley drive, the machine weighs about 4000 pounds, and complete with a motor and starter, approximately 4300 pounds.

GODFREY OXYGEN-JET CUTTING MACHINE

Various kinds of carbon and alloy steels, steel castings, and wrought iron may be cut in a Godfrey oxygen-jet cutting machine now being introduced on the American market by the Hubar-Jones Corporation, 13 Astor Place, New York City. The machine has a main slide and a cross-slide equipped with automatic screw feeds, which can also be manipulated manually, as on a milling machine, and thus enable much work to be done without the use of a templet. Square or oblong holes from 1 1/2 by 1 1/2 inches up to 3 by 3 feet can be cut without a templet. By means of trip actions on each traverse, cuts can be duplicated without resetting.



Godfrey Oxygen-jet Cutting Machine

A rotary attachment on the cross-slide permits the cutting of round holes or blanks from 1 1/2 to 36 inches in diameter in graduations of 1/32 inch. A removable graduated bar controls the path of the torch so that it can be easily set to cut the required size of hole. A rotating table can be provided which permits the cutting of disks or holes up to 14 feet in diameter or more. This table will rotate under loads up to 8 tons.

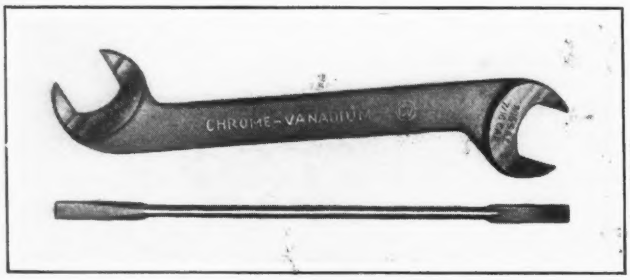
A mandrel fits into the center of the table, by means of which collars, cams, etc., can be quickly cut. This mandrel is arranged to carry a templet at the top for cutting irregular shapes. A division plate below the table provides for cutting large square, hexagonal, and octagonal nuts and other pieces without a templet, and for cutting gears, circular saw teeth, and regularly spaced holes of any shape. Templets for simple irregular shapes can be made of ply wood. For complicated shapes, the machine is equipped with a specially designed automatic attachment, together with a special machine for cutting compound ply wood templets.

Both traversing slides and the rotary attachment on the cross-slide can be operated simultaneously. Using dissolved acetylene, the torch will cut any thickness of steel up to 10 inches. It can be adjusted to any angle up to 45 degrees for cutting bevels. All valves have graduated dials so that the desired adjustments can be made instantly. Not only the pressure, but also the volume of the heating flame can be adjusted.

The machine is fitted with a speed regulator which provides the required speeds for various thicknesses of metal. The speed can be changed while the cut is in progress. A 1/4-horsepower motor drives the machine.

BONNEY HYDRAULIC-BRAKE WRENCH

A chrome-vanadium steel "Lockheed" brake wrench, the heads of which are only 7/32 inch thick, has been brought out by the Bonney Forge



Chrome-vanadium Steel "Lockheed" Brake Wrench

& Tool Works, Allentown, Pa. The thinness of the wrench heads facilitates tightening or loosening the adjusting nuts of "Lockheed" brakes, which are not readily accessible to ordinary wrenches. The wrench has a 5/8-inch opening at each end for S.A.E. 7/16-inch adjusting nuts. One opening is at an angle of 22 1/2 degrees with the handle and the other at 60 degrees, so that the adjusting nuts can be turned, no matter what their position.

"PYRO" OPTICAL PYROMETER

A simplified "Pyro" optical pyrometer, which incorporates in one small unit all parts necessary for making accurate temperature readings is being placed on the market by the Pyrometer Instrument Co., 74 Reade St., New York City. With this device, it is possible to get an accurate reading at a distance of 10 feet from an object as small as 1/4 inch in diameter or width. The instrument is used as a telescope and magnifies the object four times. The object is clearly seen through the eye-piece in its actual colors. The eye-piece can be adjusted by rotating it in order to get a clear picture. The pyrometer employs a common dry-cell battery.

In using the instrument, it is sighted in such a way that a test mark covers the object to be measured. Then the user adjusts the brightness of the range of vision until the test mark disappears. For this purpose, a circular color filter having a graduating density of color is rotated until the brightness of the test mark is matched. The temperature is then indicated on a scale. Since the pyrometer works on monochromatic light after sighting, it is necessary to insert a red glass before measuring the temperature. The normal range of the instrument is from 2000 to 3200 degrees F.

Manner of Using the "Pyro" Optical Pyrometer

CHAMBERSBURG HIGH-FRAME HAMMERS

A line of single-frame guided-ram steam or air hammers having high frames which give an unusually large amount of working space has recently been developed by the Chambersburg Engineering Co., Chambersburg, Pa. An advantage of these hammers is that they permit the forging of large disks, rings, etc., and the upsetting of high stems, form arch bars, etc., with the most economical size of tools. Long punching with drifts is also facilitated.

The steam joint employed on most hammers between the intake stuffing-box and the cylinder has been eliminated. Another advantage is that the self-draining cylinder dispenses with the long delays sometimes necessary in pumping condensate from cylinders. A patented safety cover keeps the volume of steam or air pumped per stroke at a minimum. The throttle valve is of the rotary self-seating type, and the operating valve is ground into a removable cage.

Chambersburg Hammer with Increased Distance from Die to Under Side of Frame

Vertical alignment is obtained by inserted guides which are supported wholly by the frame, each in a five-bearing pocket independent of the guide clamp bolts. The guide adjusting wedges are positioned independently of the guides and have a full bearing to avoid a rocking tendency. Tie-bars reinforce the frame at the guides.

The patented safety cylinder cover provides a cushion of live steam or air at the top of the cylinder. This provision limits the stroke to protect the cylinder, and eliminates the hazard and expense of broken cylinder covers in the event that the rod should break or loosen. A safety valve shuts off the steam or air in case the valve gear should become damaged.

Standard forging hammers of this line range in capacity from 700 to 6000 pounds, and in length of stroke, from 23 to 48 inches. Rod hammers of the line, which are particularly adapted to forging work requiring an exceptionally high clearance, range in size from 400 to 4000 pounds, and in length of stroke, from 18 to 48 inches.

GLOBE-WERNICKE FILING SYSTEM FOR DRAWINGS

A filing system for drawings, plans, and maps is being introduced to the trade by the Globe-Wernicke Co., Cincinnati, Ohio. The nucleus of this system is a clip composed of a strip of celluloid enclosed in India rubber adhesive cloth. Two of these clips are attached to the top edge of the card illustrated in Fig. 2. One end of each clip is attached by adhesion to the drawing or card. In the other end is a hole and slit that permits the sheet to be suspended by snapping the clip over a horizontal rod. Two or more clips are used per sheet, and the sheets are strung on an assembly of polished rods that are mounted in open racks, as shown in Fig. 1, or in closed cabinets which are also manufactured by the company.

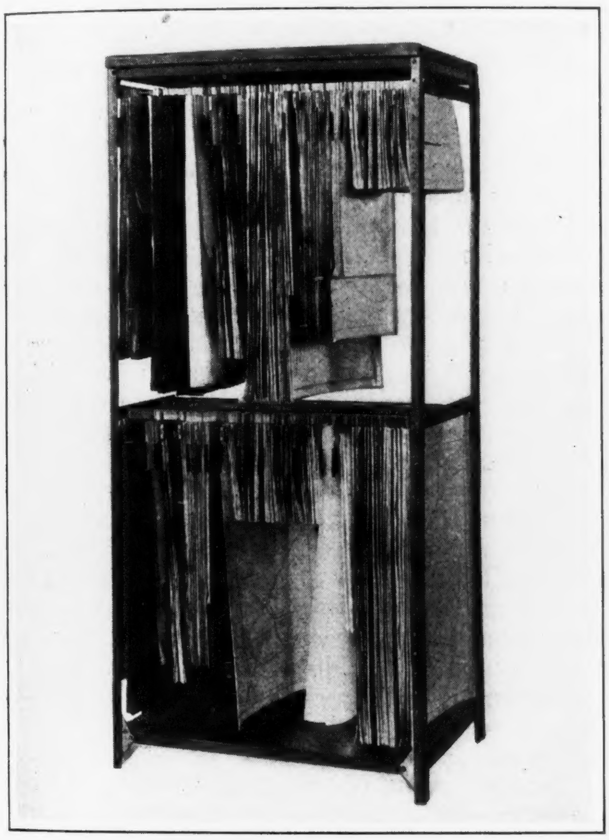


Fig. 1. Globe-Wernicke Open Racks for Filing Drawings, Tracings, etc.

Mounted on the assembly of polished rods are six riders made of ply wood, which enable the contents of the rack to be shifted laterally to permit the removal of a drawing. Guide cards of the type shown in Fig. 2 are distributed along the rod assembly to give a visible index. All sheets are visible and equally accessible, regardless of size, and may be referred to without removal from the file. An advantage claimed for the system is that the life of drawings is lengthened, because there is no friction when pulling out or "tucking in" a sheet. It is unnecessary to thumb the corners of sheets when searching for a specific drawing, thus avoiding frays, folds, etc. The clip suspension helps to preserve thin sheets, such as tracings, vellum paper, and "Ozalid" and Van Dyke prints.

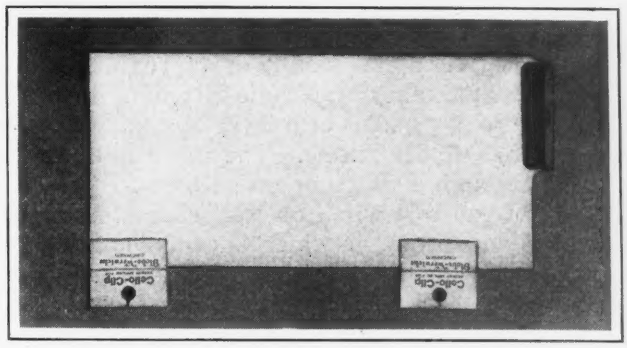


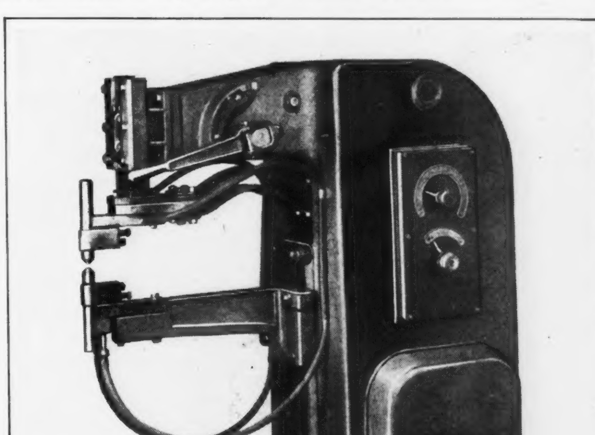
Fig. 2. Guide Card with Two "Cello-Clips"

THOMSON POWER-DRIVEN SPOT WELDER

A No. 275 power-driven spot welder which has a capacity for welding two pieces of No. 10 gage (or slightly heavier) iron or steel is the latest addition to the line of electric welding machines built by the Thomson Electric Welding Co., Lynn, Mass. The machine is equipped with a transformer having a rating of 35 kilowatts, 58 kilo-volt amperes. The core is of the double window shell type. The secondary is made of cast copper and is cooled by water circulating through seamless steel tubing cast integral with the secondary. The primary coils have taps connected to a regulator on the welder frame which gives 10 points of current variation.

The horns are 24 inches long and the lower horn is arranged to permit a drop of either 12 or 24 inches. The dies are made either solid or water-cooled, of hard drawn copper 1 1/2 inches in diameter. The die-holders are also water-cooled.

The drive unit consists of a one-horsepower motor and a spur-gear train located in the base.



Thomson Power-driven Spot Welder

On the main driving shaft, there is a cam which controls the movement of the upper welding electrode. It gives a die opening of approximately 3/4 inch. An auxiliary upper-die lift of 2 inches is provided for by means of a lever on the right-hand side of the welder frame. The drive unit is controlled through a clutch operated by a foot-treadle. A remote-control switch or wall contactor is supplied, the operation of which is controlled through a rotating switch mechanism mounted on the power drive unit. This mechanism is adjustable to permit obtaining long or short periods of welding current flow to suit conditions.

Four sets of change-gears may be furnished to give welding speeds of approximately 40, 60, 80, and 100 strokes or welds per minute. The maximum pressure on the work at the die points is approximately 600 pounds. The pressure is adjustable. The camshaft is equipped with a brake which works automatically as the cam approaches the rest position. The net weight of this machine is approximately 3100 pounds.

DEFIANCE GRINDING AND POLISHING MACHINES

Two new machines, a No. 725 vertical revolving-table grinding and polishing machine, and a No. 726 motor-driven flexible-belt variety polishing machine, have been added to the products of the Defiance Machine Works, Defiance, Ohio. The first-mentioned, which is illustrated in Fig. 1, has been designed for grinding or polishing flat surfaces such as the center of steering wheel spiders, the seats for automobile wheel flanges, and similar work. It may also be used as a wood boring machine to produce center holes in automobile wheels and to drill flange bolt holes, etc.

The revolving table is mounted on a swinging arm that can be adjusted off center. The table is power-driven. The spindle travels through a splined sleeve and has 8 inches of vertical movement. The maximum distance from the nose of the spindle to the table top is ordinarily 14 inches, but by dropping the table to the base, the distance can be increased to 20 inches. The spindle can be fitted with disks up to 10 inches in diameter, the faces of which are covered with polishing material. It may also be equipped with an expanding chuck for holding 4-inch diameter cup grinding wheels or with a universal chuck for receiving boring bits having a 1/2-inch shank or smaller. The spindle can be raised and lowered either by hand or foot.

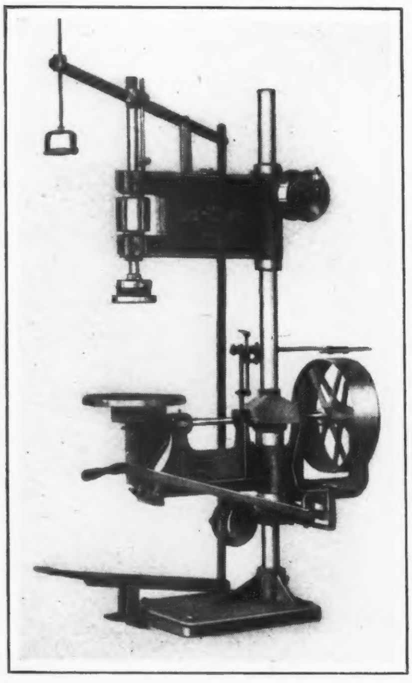


Fig. 1. Defiance Grinding and Polishing Machine with Revolving Table

Attached tight and loose pulleys are regularly furnished for feeding the revolving table. The machine may be driven by a three-horsepower motor and weighs approximately 1000 pounds.

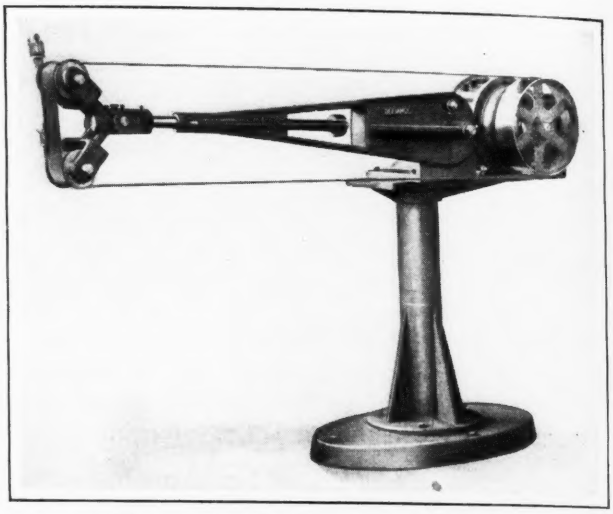


Fig. 2. Defiance Flexible-belt Variety Polishing Machine

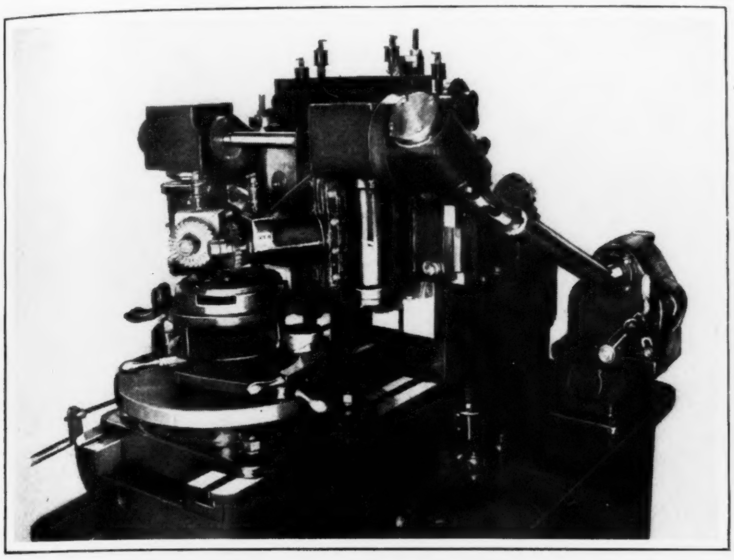
The flexible-belt polishing machine is illustrated in Fig. 2. It was designed especially for finishing the curved surfaces of automobile steering-wheel rims, mirror frames, irregular-shaped metal parts and similar work. It is usually furnished with pulleys to accommodate a polishing belt 2 inches wide, although it can be arranged to carry wider belts. The belt is 148 inches long.

The adjustable arm which supports the two idler pulleys can be set to suit the convenience of the operator and the character of the work. The yoke which supports the idler pulleys is controlled by coil springs located on each side of the arm. These springs are attached to an adjustable collar fitted to the spindle, and provide a means of obtaining the proper amount of tension on the belt. All running parts of the machine are accurately balanced so as to permit a polishing belt speed of 5000 feet per minute. The machine is driven by a two-horsepower motor and weighs about 480 pounds.

BILTON "PRODUCTO-MATIC" ARRANGED FOR MILLING CLUTCH PLATES

Six slots can be milled in clutch plates in one operation on a "Producto-Matic" milling machine recently designed by the Bilton Machine Tool Co., Bridgeport, Conn. Three of these slots are produced in bosses near the outer rim of the clutch plates, and three in the hub near the middle of the plates. From the illustration, it will be seen that the machine has two cutter-spindles opposed to each other at an angle of 60 degrees, so as to permit the slots to be milled at spacings of 120 degrees as the work-holding fixture is indexed. The cutters are fed vertically by means of a rack and segment operated through a lever and cam. Both cutter-spindle housings are independently adjustable for various depths of cut.

The two spindle housings are mounted on a vertical slide. Spiral bevel gears in the spindle hous-



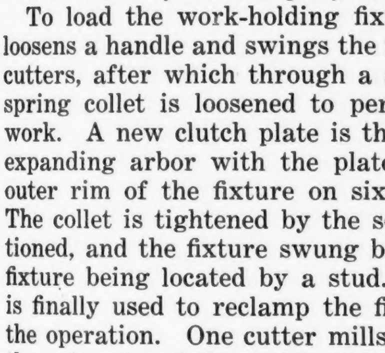
Milling Slots in Clutch Plates with a Bilton "Producto-Matic"

ings transmit power to worms which drive worm-gears on the respective spindles. The horizontal shaft near the top of the machine transmits power from one spindle housing to the other. All shafts are carried in Timken tapered roller bearings. The machine itself is the regular No. 46 "Producto-Matic" built by the company mentioned.

To load the work-holding fixture, the operator loosens a handle and swings the fixture clear of the cutters, after which through a second handle, the spring collet is loosened to permit removing the work. A new clutch plate is then placed over the expanding arbor with the plate resting near the outer rim of the fixture on six bearing surfaces. The collet is tightened by the second handle mentioned, and the fixture swung back into place, the fixture being located by a stud. The first handle is finally used to reclamp the fixture in place for the operation. One cutter mills the three slots on the outer rim of the clutch plate, and the other cutter, the three slots on the hub. When the last cut has been made, the machine stops automatically. A production of 100 pieces per hour is averaged.

FORBES & MYERS FREQUENCY CHANGER

In July, 1926, MACHINERY, was published a description of a frequency changer manufactured by Forbes & Myers, 172 Union St., Worcester, Mass. For a few frequencies this concern now makes a changer of simplified construction in which collector rings and brushes are eliminated. This frequency changer is being placed on the market in capacities of from 1/10 to 3 kilovolt-amperes for changing two- or three-phase, 60-cycle current, into one-, two- or three-phase current of 180 cycles.

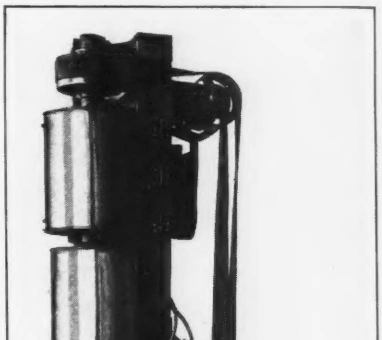


Forbes & Myers Frequency Changer

The principal application of the frequency changer is expected to be in the operation of high-speed motors. As is well known, the highest speed that can be obtained with a simple induction motor on 60-cycle current is 3600 revolutions per minute. The same simple induction motor that makes 3600 revolutions per minute on 60-cycle current will run at 10,800 revolutions per minute on 180-cycle current. One frequency changer can operate one or more high-speed motors. Motors of this type are used for driving small grinding wheels, drills, centrifugal separators, wood-working tools, etc.

REYNOLDS NUT DRIVING MACHINE

A machine designed for use in assembling operations requiring the driving of nuts, cap-screws, etc., has been developed by G. D. Reynolds and is built by the Metalwood Mfg. Co., 3358-66 Wight St., Detroit, Mich. The machine illustrated has two spindles and is adapted to the assembly of bearing caps, valve bonnets, motor end plates, connecting-rods preparatory to reaming, or any work which requires driving and tightening of nuts or screws in pairs.



Reynolds Nut Driving Machine

The illustration shows a two-horsepower constant-speed motor drive, although a countershaft drive can be furnished. The belt from the motor passes over idler pulleys to a driving pulley at the top of the machine. The lower end of the drive shaft carries the driving end of a magnetic clutch. The driven end of this clutch is carried on a bronze casing which contains differential gearing through which the two spindles are driven. One spindle is mounted in a slide which is adjustable to permit setting the spindles at any center distance from 2 1/16 to 6 inches.

The lower end of each spindle carries a detachable socket wrench into which the nut or cap-screw is placed and held by magnetism. Below the spindles there is a bracket which is moved vertically on the column through the foot-lever, this bracket being designed to hold a table or fixture for carrying the parts to be assembled. On one side of the column there is a mechanical switch which opens

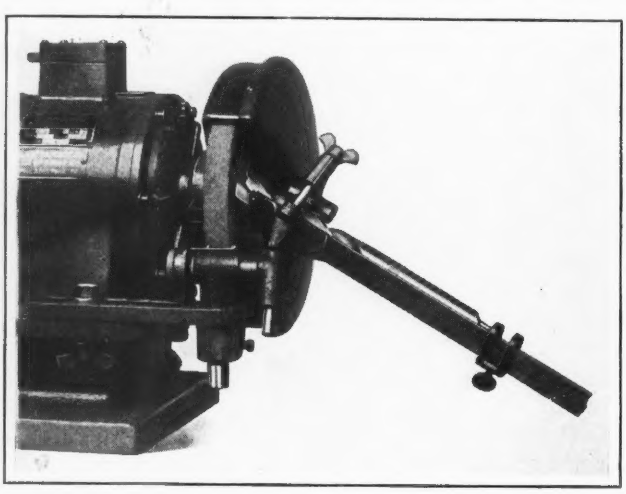
and closes the magnetic clutch circuit at the proper time.

In operation, the nuts or cap-screws are placed in the stationary socket wrenches, and the parts to be assembled are located in the fixture in line with the spindles. As the foot-lever is depressed, the work-bracket moves upward and a swinging cam closes a switch, energizing the magnetic clutch and starting the spindles. As the foot-lever is further depressed, the nuts or screws are driven to a tightness predetermined by the rheostat adjustment. When the magnetic clutch starts to slip, the mechanical switch opens the clutch circuit, releasing all torque on the spindles and allowing the work to be freely withdrawn from the wrenches by releasing the foot-lever.

TWIST DRILL GRINDING ATTACHMENT

A twist drill grinding attachment has been added to the line of the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio. This device is shown attached to an electric bench grinder having wheels 10 inches in diameter. It gives the advantage of two distinct machines in one. The attachment is easily interchanged with the regular tool grinding rest, and enables the operator to grind drills more rapidly and accurately than by hand.

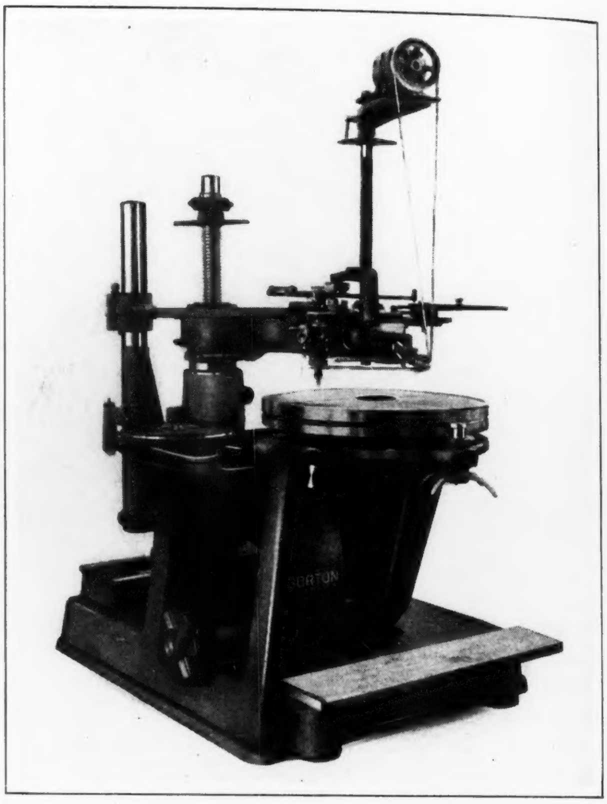
Gages are not required, as the device is equipped with a graduated micrometer screw which is adjusted to make lip lengths identical. A medium-grade grinding wheel of No. 60 grit should be used and kept dressed to a straight surface. Either straight- or tapered-shank twist drills ranging in size from 1/4 to 1 1/4 inches in diameter can be ground. The attachment can be furnished for any standard grinder having wheels up to 12 inches in diameter.



Twist Drill Grinding Attachment Made by the Standard Electrical Tool Co.

GORTON TIRE-MOLD ENGRAVING MACHINE

The latest addition to the line of engraving machines built by the George Gorton Machine Co., Racine, Wis., is a No. 3-H tire-mold lettering machine. It is designed to accommodate the heaviest of steel tire molds and while it has a much heavier cutter-head, spindle, and pantograph than the No. 1-H machine, it has the same reductions and can therefore employ any copy used on that machine. Reductions from 3 to 1 down to 0 to 0 are obtainable. The machine weighs 4500 pounds.



Gorton Heavy-type Tire-mold Engraving Machine

Unlike the smaller machines, the new machine is provided with an arrangement for indexing each letter; hence, a number of molds of the same size can be made with identical lettering so far as the size of letters, spacing, etc., is concerned. The table is capable of carrying a safe load of 8000 pounds and is mounted on heavy ball bearings.

Molds up to 14 inches thick can be handled, and the table will swing work having a maximum outside diameter of 72 inches. With the table horizontal, the machine will engrave on a 54-inch diameter circle to within 5 inches of the table center, and with the table at an angle of 30 degrees, the machine will engrave on a circle 60 inches in diameter on a mold 14 inches thick, to within 8 inches of the table center.

The spindle is mounted on ball bearings, and regularly has a speed of 5000 revolutions per minute, but speeds as high as 8000 revolutions per minute and as low as 1800 revolutions per minute are obtainable. The spindle is equipped with collet bushings for 1/8-, 3/16-, 1/4-, and 5/16-inch diameter straight-shank cutters. An adjustable feed-stop graduated in thousandths of an inch is provided for the spindle. The vertical spindle feed is 7/16 inch. The machine is equipped with a forming bar and will engrave concave, convex, and spherical surfaces.

* * *

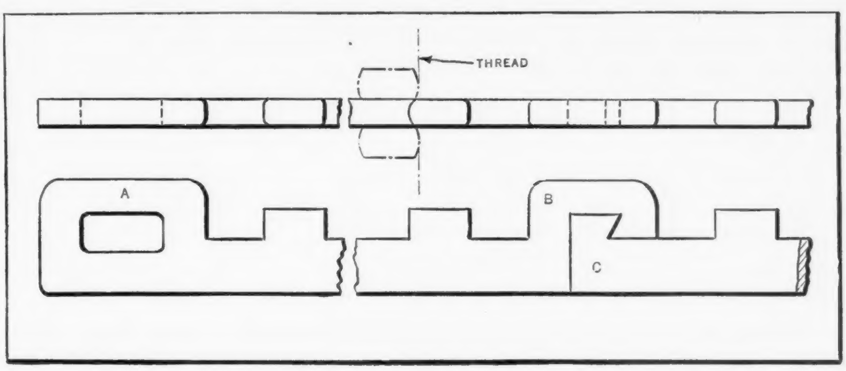
There was a sharp decline in the imports of machine tools into Italy during the first quarter of 1927, statistics for which have just been made available. The decline affected particularly machinery from the United States and Germany.

PATTERN REQUIRING EXACT ALLOWANCE FOR SHRINKAGE

By W. S. BROWN

Rarely is the patternmaker called upon to work with such precision and estimate so accurately the possible shrinkages as in the case of guide rack patterns for cotton drawing frames, like those here illustrated. The racks are of three styles, one having ends as shown at *A* and *B*, the second having ends as shown at *C* and *B*, and the third having one end like that shown at *C* and the other end terminating in a plain tooth. Each of these racks is about 24 inches long, 7/8 inch wide over the teeth, and 9/32 inch thick. The racks are coupled together, end to end, by means of the dovetail joint shown.

In assembling the racks, one rack of the first style and one of the third style are used at the respective ends of the assembly, and between the two end racks are placed from forty to fifty of the second style of rack, depending on the length of the machine. By means of loop *A*, the string of racks is given a reciprocating motion of about 11/16 inch. This motion, being a little greater than that of the width of a tooth space, causes the teeth slightly to overlap the teeth of two rows of similar, but stationary racks between which the reciprocating string of racks is located.



Cast Bronze Racks that Presented a Difficult Patternmaking Problem

On the inward stroke of the frame, the rack tooth space supports the cotton threads which slide through at a high speed. This action results in unbelievable wear on the extremely hard bronze rack castings. The grooves developed often have a depth as great as 3/16 inch and a width slightly greater than the diameter of the thread. At the beginning of the upward stroke, the string of racks moves over so that the threads are gripped between the sides of the overlapped teeth, thus enabling them to be "drawn."

It is obvious that with such a large number of racks assembled, the length tolerances for the castings must be exceedingly small; in fact, they are required to be about 1/32 inch in the rough. A certain amount of selective assembling is possible in arranging over-size and under-size racks in the machine, so that the slight variations are balanced out in the total assembly. In addition to the tolerance on the over-all length, the tooth pitch is also required to be held close to size. The finishing of the teeth consists merely of removing the rough edges, leaving as much of the hard bronze as possible to resist wear.

The dovetail joint is required to be a snug fit and interchangeable. The bottom edges are also required to be kept straight and in alignment, although the limits on the cost of production made it necessary to have the joints fit properly with practically no hand fitting or filing. The number of frames required justified the use of metal patterns, and these were really necessary in order to avoid the springing and warping that occurs in patterns made of wood.

First a mahogany pattern was made, having double shrinkage allowances for the aluminum patterns used in making the molds for the bronze racks. From the mahogany pattern about thirty aluminum castings were made at various heats, and these were grouped into five lots according to their lengths. One casting of each group was prepared for use as a test pattern, to determine which one produced a bronze casting of the correct dimensions. The remaining aluminum castings in the group were then finished and employed as patterns in casting the bronze racks.

By using this method of obtaining patterns and giving close attention to uniformity in pouring temperatures and other conditions, excellent results were obtained. Cast bronze is used for the racks, as it is harder and cheaper than rolled stock; steel cannot possibly be used, owing to its tendency to rust in a moist atmosphere.

After being in service for some time, the grooves worn in the racks by the thread weakened the racks to such an extent that they broke under the severe strain of the reversing stroke. It was found that the broken racks could usually be repaired at least once by aligning the pieces in a sand mold and "burning" the ends by pouring new molten metal around the joint.

* * *

SUGGESTIONS FROM EMPLOYES

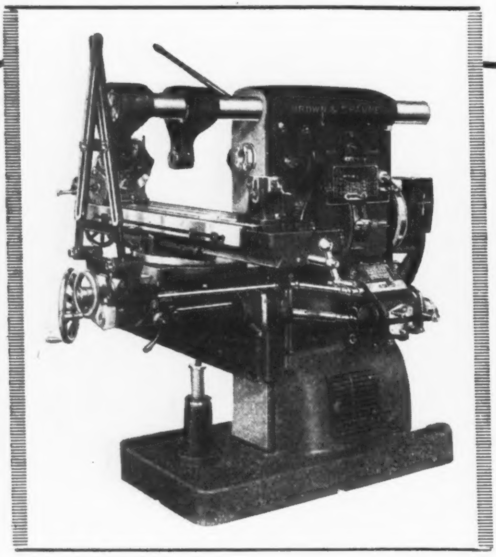
A report recently issued by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co. gives the following essentials for successful employe suggestion systems: Active cooperation on the part of department heads; publicity that keeps the plan before the employes; a clean-cut statement of purposes and details of the plan; an easy method for submitting suggestions; immediate acknowledgment of the receipt of suggestions; a fair unbiased method of judging them; a satisfying statement of reasons for rejections; and adequate rewards for accepted suggestions. Constructive suggestions from the workers not only indicate a progressive organization, but also contribute to financial success. Sixty-six well-known companies have assisted in compiling this report.

* * *

INDEX TO MACHINERY

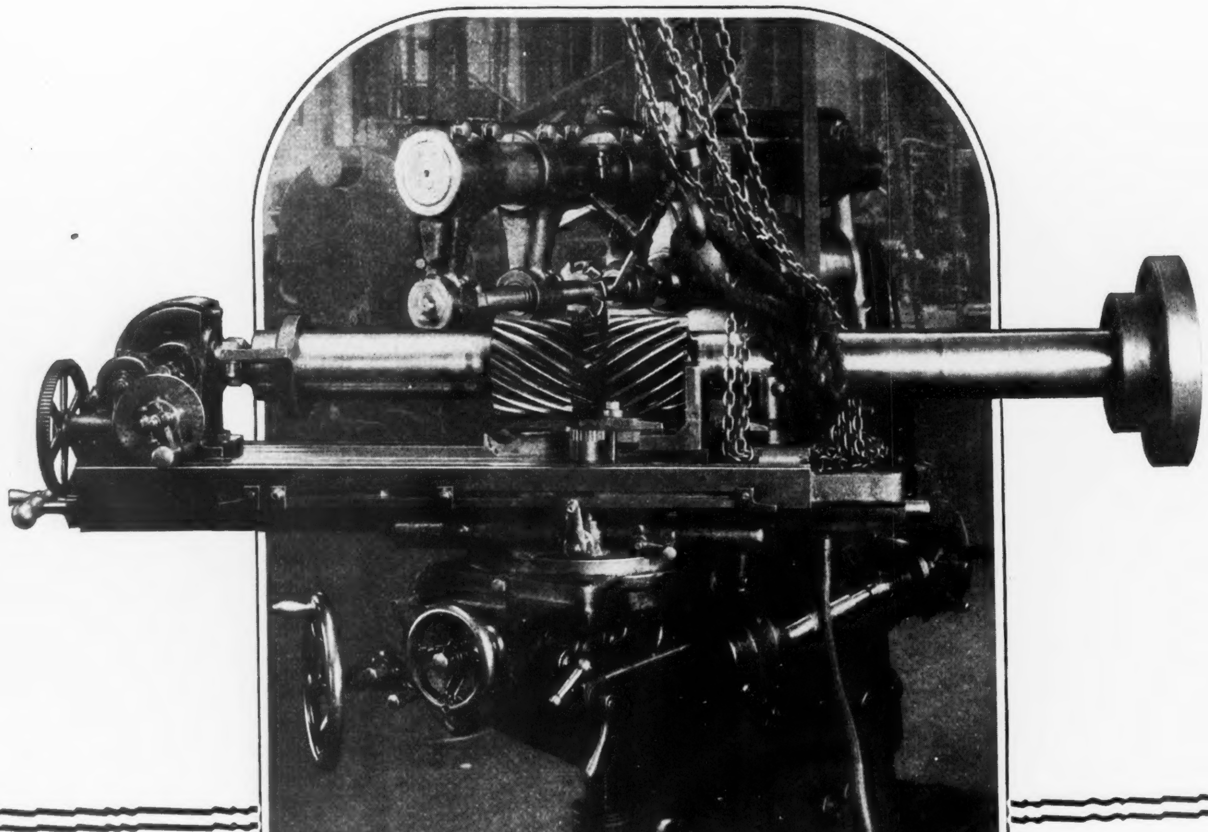
The annual index to the thirty-third volume of MACHINERY (September, 1926, to August, 1927, inclusive,) is now ready for distribution. Copies will be sent to readers upon request.

Judge these machines by the records of their ber

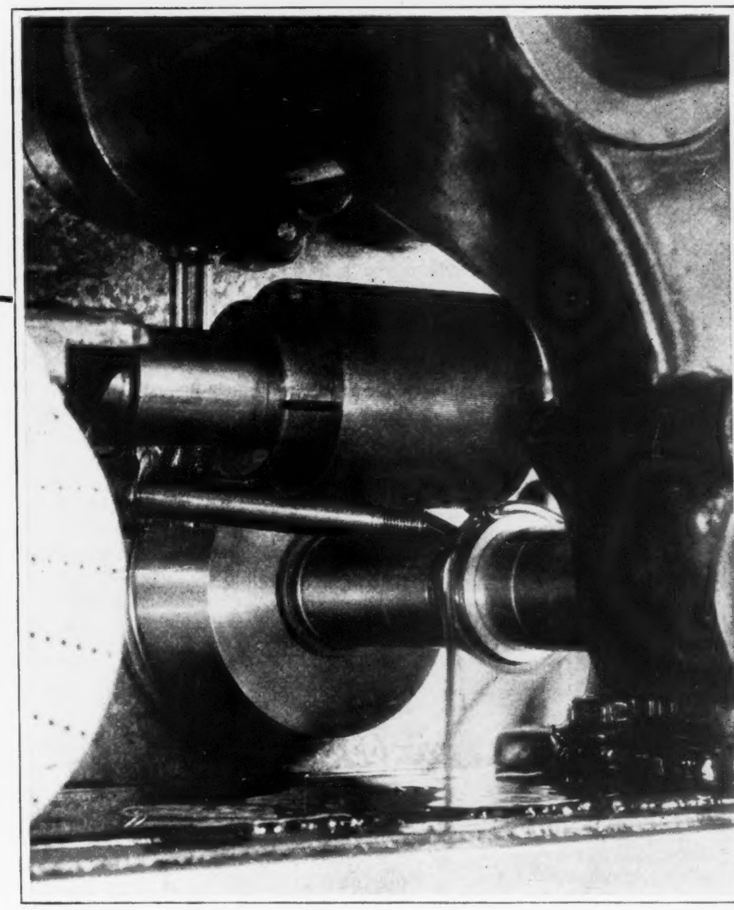


Consider the repair job illustrated below. It was necessary to mill out the bottom of the spaces between the teeth of a large herring-bone gear to provide better clearance for the mating gear. The shaft on which the gear had been cut weighed over 500 lbs. The job was set up and completed on a Brown & Sharpe No. 3 Universal Milling Machine of the Cone Drive type in a comparatively short time.

Jobs like this do not arise every day in the average plant. But the shop with a Brown & Sharpe Universal can feel confident of handling such work economically when it does arise, and all the general run of toolroom and repair work meanwhile.



performance



Sawing 300 slots in the periphery of this cylinder .017 of an inch apart and 1/4 inch deep required a machine that would operate with extreme accuracy. A modern Brown & Sharpe No. 3A Universal Milling Machine was chosen for the job and the results were completely satisfactory. (Note that the cutter runs beneath the work so that the chips will fall away and not accumulate in grooves.)

Whether precision or power is required, or both, there is a Brown & Sharpe Universal that will mill any job within its remarkably broad range satisfactorily and at a low cost.

Perhaps your plant has grown without your noticing it to the point where the purchase of a Brown & Sharpe Universal would be a profitable investment. In a number of such cases, our representative has been able to point out that the savings on outside repair jobs would easily cover the price of the machine within a short time.

Let our representative go over your requirements with you, or write direct for specifications.

BROWN & SHARPE
UNIVERSAL
MILLING MACHINES

Cone Drive
Nos. 1, 2, and 3

Constant Speed Drive
Nos. 1A, 2A, 3A, 4A, and 4A Heavy

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

PERSONALS

Victor Allen, sales manager of the Automotive Maintenance Machinery Co., Chicago, Ill., for the last three years, has been appointed vice-president in charge of sales.

R. P. Nick has been transferred from the Baltimore, Md., office of the Lincoln Electric Co., Cleveland, Ohio, to the Lancaster, Pa., office, where he will be in charge of the sale of "Linc-Weld" motors and "Stable-Arc" welders.

Clayton E. Wyrick, Technical Engineer, Gairing Tool Co.

Clayton E. Wyrick, who for the last fifteen years has maintained a consulting engineering business in Detroit, Mich., in both the automotive and the general mechanical fields, and who for the last four years has had charge, in a consulting capacity, of the engineering work of the Gairing Tool Co., Detroit, manufacturer of counterbores, spot-facers, core-drills, and special cutting tools, is now connected directly with the Gairing Tool Co. in the capacity of technical engineer.

Dr. W. D. Coolidge, assistant director of the research laboratory of the General Electric Co., Schenectady, N. Y., has been awarded the Hughes medal by the Royal Society for "distinguished work on X-rays and the development of highly efficient apparatus for their production."

Joseph Wainwright, for many years associated with Manning, Maxwell & Moore, Inc., of New York City, has joined the sales organization of the Consolidated Machine Tool Corporation of America, with headquarters at Rochester, N. Y.

Harry E. Mathews has been appointed manager of the Charlotte, N. C., office of the Morse Chain Co. to fill the vacancy caused by the death of George W. Pritchett. Mr. Mathews has been assistant manager of the Charlotte office for the last eight years.

Charles C. Phelps, combustion engineer, announces the removal of his office from Paterson, N. J., to 30 Church St., New York City, Room 528, where he will continue to act as representative for the Power Plant Equipment Co., Uehling Instrument Co., A. W. Cash Co., and Williams Gauge Co.

Richard Devens, for twenty years New York manager of the Brown Hoisting Machinery Co., Cleveland, Ohio, has joined the Link-Belt Co., Chicago, Ill., as sales engineer for the sale of Link-Belt crane products in the eastern territory. His headquarters will be at 235 Broadway, New York City.

Arthur H. Adams, assistant superintendent of manufacturing development at the Hawthorne, Ill., Works of the Western Electric Co., Inc., assumes, on December 1, 1927, the position of technical adviser to the president of the Manhattan Electrical Supply Co., with headquarters at 11 Park Place, New York City.

Herbert A. Johnson has been appointed New York manager of the Leipzig Trade Fair, Inc., to succeed the late E. A. Boettcher. The New York headquarters are at 630 Fifth Ave., New York City, and all information concerning the next fair, which will be held in March, can be obtained by communicating with Mr. Johnson at that address.

S. T. Massey, assistant general manager of the Heald Machine Co., Worcester, Mass., sailed on the *Berengaria* November 2 for a business trip to Europe. The purpose of Mr. Massey's trip is to make a rearrangement of dealers and check up on patents which have recently been taken over from the Giddings & Lewis Machine Tool Co. He will visit England, Germany, Switzerland, and France, and expects to sail for home in about five weeks.

T. Latimer Ford has been elected vice-president of the American Hammered Piston Ring Co., Baltimore, Md. Mr. Ford has been connected with the company for many years. He was assistant secretary and treasurer for several years, and during the last four or five years has had charge of the Pacific Coast territory. In addition to such executive duties as are required by his position, he will have charge of automotive replacement sales. Mr. Ford's headquarters will be at the main office of the company in Baltimore.

Waldo Guild, who has been assistant chief engineer of the Heald Machine Co., Worcester, Mass., is now chief engineer. Edward Taylor is assistant chief engineer, and Mr. Quimby assumes the position of chief draftsman in charge of detailing and new design. All new designing and detailing work will be done in the engineering department, while jigs and fixtures, suggestions, and service work for the customer will be carried on under the direction of Dwight C. Page, of the sales service engineering department.

Edward L. Leeds has resigned as vice-president and director of the Niles-Bement-Pond Co. of New York, and vice-president of the Pratt & Whitney Co. of Hartford, Conn., in order to devote his time to his personal interests. Mr. Leeds has been identified with the machinery industry for a number of years. Beginning his engineering career with the Yale & Towne Mfg. Co. of Stamford, Conn., he later became associated with the Brown Hoisting Machinery Co. of Cleveland, Ohio, as assistant general manager, and afterward European manager with headquarters in London, England. He has been associated with the Niles-Bement-Pond and Pratt & Whitney companies since 1906 as manager of the railway department general sales manager, and vice-president. Mr. Leeds contemplates taking a short vacation, after which he will announce his future business plans.

OBITUARY

Norman Spear Lawrence, vice-president and director of sales of the Whiting Corporation, Harvey, Ill., died suddenly October 26, following a brief attack of pneumonia. Mr. Lawrence was born May 9, 1882 at Chicago, Ill., and was educated in the schools of Chicago. He graduated from Cornell University in the class of 1904 as a mechanical engineer, and shortly after entered the employ of the Whiting Corporation as an estimator, becoming successively chief estimator, assistant sales manager, vice-president, and director of sales. During the last few years, Mr. Lawrence was also president of the Swenson Evaporator Co., a subsidiary of the Whiting Corporation.

Mr. Lawrence had a wide acquaintance in the iron and steel manufacturing field, and played an active part in various business associations, such as the American Foundrymen's Association, Foundry Equipment Manufacturers' Association, Electric Overhead Crane Institute, and others. He was a member of the American Society of Mechanical Engineers and of several social clubs.

GODDARD HONORED BY EMPLOYES

On the day of the tenth anniversary of the starting of the business of the Goddard & Goddard Co., Inc., Detroit, Mich., A. N. Goddard, president and founder of the company, was honored by his associates and employes in a manner that demonstrated the soundness of the principles that have guided him in the "management of men" during the last ten years.

A. N. Goddard, President of the Goddard & Goddard Co., Inc.

Upon his return from a business trip, Mr. Goddard was asked to step back to the rear of the shop, where the employes were gathered, the power of the plant having been turned off. Realizing an unusual condition, he rushed into the midst of the gathering, expecting that some serious accident or breakdown had taken place. Instead, he found himself presented, by the employes, with a Pontiac coupé, which was tendered to him with a few well-chosen words by H. Hagerty, who acted as spokesman for the shop and office force of 150 people, gathered together for the occasion. In view of this expression of friendly feelings on the part of the employes, it might be mentioned that "labor turnover" is practically an unknown term in this shop.

TRADE NOTES

COOPER HEWITT ELECTRIC CO. has moved its general offices to the company's new building at 410 Eighth St., Hoboken, N. J.

MARSHALL & HUSCHART MACHINERY CO. OF INDIANA has moved to new quarters at 1020 Chamber of Commerce Building, Indianapolis, Ind.

ADRIANCE MACHINE WORKS, INC., 78 Richards St., Brooklyn, N. Y., has appointed the Vernier Steel Products Co., 1928 Monterey Ave., Chicago, Ill., factory representative for the Chicago territory.

MANLEY MFG. CO., York, Pa., has taken over the automotive sales of the Ford Chain Block Co. of Philadelphia, Pa., which was recently acquired jointly by A. P. Van Schaick and W. M. Wheeler of the American Chain Co.

ROLLWAY BEARING CO., INC., Syracuse, N. Y., has opened a sales office at 956 Leader Bldg., Cleveland, Ohio. R. D. Faris has been appointed Cleveland district representative, and will make his headquarters at the new office.

FERGUSON GEAR CO., Gastonia, N. C., has opened a new branch office at 77 Cortlandt St., New York City, which will cover the territory included by the New England states, New York, New Jersey, Pennsylvania, Delaware, and Maryland.

NORTHERN BLOWER CO., Cleveland, Ohio, announces that its "Norblo" trademark and the word "Norblo" as applied to its dust collecting systems, sand-blasting equipment and similar air-operated apparatus, have been registered officially at the United States Patent Office.

REED-PRENTICE CORPORATION, 677 Cambridge St., Worcester, Mass., has appointed the Federal Machinery Sales Co., 17 S. Jefferson St., Chicago, Ill., sales representative of the company, handling the sale of the line of Becker vertical milling machines in the Chicago territory.

HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., announces that it is now prepared to supply completely machined gears and cams and thread-milled products, having recently installed up-to-date gear-cutting, cam-cutting and thread-milling equipment for this purpose.

FALK CORPORATION, Milwaukee, Wis., has made arrangements with William Kennedy & Sons, Ltd., Owen Sound, Ont., Canada, by which this company will manufacture and sell in Canada Falk continuous-tooth herringbone gears, herringbone speed reducers, and flexible couplings.

BROWN TOOL CO., 616 St. Clair Ave., N.E., Cleveland, Ohio, has been appointed exclusive representative of the Sundstrand Machine Tool Co., Rockford, Ill., for this company's line of Rigidmils, milling machines, stub lathes and automatic lathes, in the Cleveland and Toledo territories.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., has taken over the distribution of the Foote-Burt line of drills to the railroads. The Foote-Burt equipment includes machines for single- and multiple-spindle drilling of a great variety of work, such as mud rings, flue sheets, etc.

ACKLIN STAMPING CO., 1925 Nebraska at New York Central Railway, Toledo, Ohio, has opened a Detroit sales office at 3-239 General Motors Building, of which Harold Jay will be in charge as district manager. Mr. Jay has had about eight years' experience in sales work in the central office of the company.

BERKSHIRE MFG. CO., manufacturer of foundry equipment, has consolidated its plant with that of the Hill Clutch Machine & Foundry Co., and is now located at 6400 Breakwater Ave., Cleveland, Ohio, having moved from 1011 Power Ave. The consolidation will not affect the personnel of either company.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., has let the contract for a new addition to its plant, 75 by 176 feet, which will give the company 13,400 square feet of additional floor space. The demand for the new "Mil Waukee-Mil" has made this increase in manufacturing facilities necessary.

LINCOLN ELECTRIC CO., Coit Road and Kirby Ave., Cleveland, Ohio, manufacturer of "Link-Weld" motors and "Stable-Arc" welders, has appointed E. A. Thornwell of Atlanta, Ga., representative of the company for Georgia and eastern Tennessee. John Van Horn, factory engineer for the company, will assist Mr. Thornwell.

PARKER-KALON CORPORATION, manufacturer of hardware and sheet metal workers' specialties, has moved its factory and general offices from 352 W. 13th St., New York City, to 200 Varick St. The entire sixth floor and half of the fifth floor will be occupied by the company, the new quarters affording a total floor space of 55,000 square feet.

QUEEN CITY MACHINE TOOL CO., Cincinnati, Ohio, has turned over all patterns, jigs, and special tools to the MANUFACTURERS GEAR & MACHINE CO., McMicken Ave. and Tafel St., Cincinnati, Ohio, who will furnish repairs for Queen City shapers and later will manufacture this line of machine tools. Time will be saved by sending orders directly to the latter concern.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., announces that Alfred L. Carlson has joined the company as sales engineer, with headquarters in New York City, and will have charge of the eastern territories. Mr. Carlson was formerly connected with the Gisholt Machine Co. of Madison, the Otis Elevator Co. of New York, and the Henry Prentiss Co. of New York.

JOHN WARREN WATSON CO., manufacturer of Watson stabilators, has begun construction on a large addition to its plant situated at Bridesburg Station in northeast Philadelphia. In addition to the office extension, the new addition will be approximately 120 feet wide by 950 feet long, and will comprise about 120,000 square feet of floor space, more than doubling the capacity of the present plant.

SAFETY TOOL CORPORATION, Watertown, N. Y., manufacturer of the Skrov-Zow file handle, at the annual meeting of stockholders, elected the following directors: W. H. Gilman, president; M. A. Long, vice-president; and George Duffy, secretary and treasurer. The company has opened a new central office at 12 Otis Building, Watertown. It is requested that all correspondence be sent to this address.

W. O. BARNES CO., INC., Detroit, Mich., manufacturer of hacksaws and band saws, has appointed the Hansen & Yorke Co., Inc., 88 Warren St., New York City, distributor of Barnes products in the metropolitan district. Frank M. Shaw and William Gross, the Barnes Co.'s service men, will make their headquarters with the Hansen & Yorke Co., Inc. The New York office of the W. O. Barnes Co., Inc., at 41 Murray St. was discontinued on November 1.

NORTON CO., Worcester, Mass., has opened a new storehouse at 5805 Lincoln Ave., which will house the district offices and store-rooms formerly located at 233 W. Congress St. The new building is a three-story brick structure, 124 feet by 100 feet. More than half of the 50,000 square feet of floor space has been designed to store grinding wheels and other abrasive products. The basement of the building is given over almost entirely to stock-rooms. The first floor will contain stock-rooms, a truing room where wheels are aligned, the shipping department, and a demonstration room for grinding machines.

HARRINGTON CO., 17th and Callowhill Sts., Philadelphia, Pa., manufacturer of machine tools and chain hoists, has made arrangements with the Consolidated Machine Tool Corporation of America to take over the machine tool business of the company. This department will be moved to Rochester, where the manufacture and sale of the machines will be continued by the Consolidated Machine Tool Corporation of America. By disposing of this department of the business, the company will be able to devote its entire time and energies to the manufacture of its line of chain blocks, electric hoists, trolleys, and kindred material-handling equipment at the Philadelphia plant.

OAKITE PRODUCTS, INC., formerly the Oakley Chemical Co., 26 Thames St., New York City, held its eleventh annual sales conference at its general offices in New York City November 7 to 9. At this conference over eighty of the field representatives of the Oakite Products, Inc., were present, in addition to the executives and staff of the home office. Technical sessions were held at which a great number of papers were read relating to both the technical and business aspects of the use of Oakite products. Among these papers may be mentioned the following: "Some Newer Oakite Methods and Equipment for Railroads," by L. B. Johnson; "Developments in Cleaning Operations for the Oil Industry," by George Boeck; "Handling Metal Cleaning and Rust Prevention Problems," by J. A. Maguire; "Oakite Materials in Automobile Service Stations," by C. A. Peterson; and "Electro-plating Methods, Particularly Cleaning," by H. C. Bernard.

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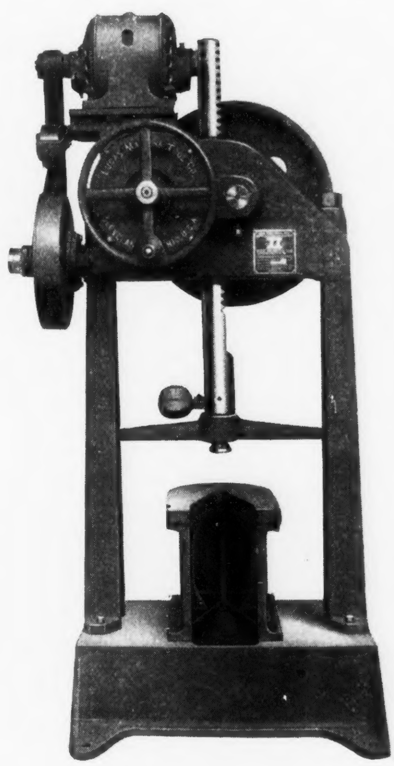

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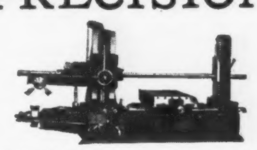

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COMING EVENTS

DECEMBER 5-9—Annual meeting of the American Society of Mechanical Engineers at the society's headquarters, Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary.

DECEMBER 5-10—Sixth national exposition of power and mechanical engineering at Grand Central Palace, New York City. Address inquiries to International Exposition Co. Grand Central Palace, New York City.

DECEMBER 7—Annual meeting of the Power Transmission Association in Tavern Room C, Hotel Commodore, New York City, at 10 A. M. W. S. Hays, executive secretary, 644 Drexel Bldg., Philadelphia, Pa.

FEBRUARY 14-17, 1928—Third Mid-west power conference to be held in Chicago, Ill., under the auspices of nine national and local engineering societies, including the Chicago Section of the American Society of Mechanical Engineers. Fred B. Orr, secretary-treasurer, Room 1136, 72 W. Adams St., Chicago, Ill.

NEW BOOKS AND PAMPHLETS

NOTES ON MACHINING ALLOY STEEL. 7 pages, 8½ by 11 inches. Published by the International Nickel Co., Inc., 67 Wall St., New York City, as No. 11 in a series on nickel steel data and applications.

TESTING OF LINE STANDARDS OF LENGTH. 22 pages, 7 by 10 inches. Circular of the Bureau of Standards No. 322. Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.

TESTING OF MEASURING TAPES AT THE BUREAU OF STANDARDS. 16 pages, 7 by 10 inches. Circular of the Bureau of Standards No. 328. Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.

UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR PACKING, HARD FIBER SHEET. 2 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Circular No. 335 of the Bureau of Standards. Price, 5 cents.

CARNEGIE BEAM SECTIONS. 19 pages, 5 by 7½ inches. Distributed by the Carnegie Steel Co., Pittsburg, Pa.

This little pamphlet gives data on the profiles, properties, and safe loads for additions to the new series of Carnegie structural steel beams and column sections.

ELECTRODEPOSITION OF CHROMIUM FROM CHROMIC ACID BATHS. By H. E. Haring and W. P. Barrows. 37 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper No. 346 of the Bureau of Standards. Price, 15 cents.

COMPARISON OF AMERICAN, BRITISH, AND GERMAN STANDARDS FOR METAL FITS. By Irvin H. Fullmer. 7 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper No. 344 of the Bureau of Standards. Price, 10 cents.

MACHINERY. 43 pages, 6 by 9 inches. Published by the Bureau of the Census, Department of Commerce, Washington, D. C., as part of the Census of Manufactures for 1925. Price, 10 cents.

This census covers metal-working machinery (including machine tools) pumps and pumping equipment, textile machinery and parts, typewriters, foundry and machine shop products.

INDEX TO PROCEEDINGS OF THE AMERICAN SOCIETY FOR TESTING MATERIALS (1921-1925). 224 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price: cloth-bound, $2.50; half-leather binding, $3.50.

This represents a collective index, classified both by subjects and by authors, of the proceedings of the society, published in Volumes 21 to 25, covering the years 1921 to 1925.

NEMA HANDBOOK OF SUPPLY STANDARDS. 231 pages, 6 by 9 inches; 125 illustrations and diagrams. Published by the National Electrical Manufacturers' Association, 420 Lexington Ave., New York City. Price, $3.50.

This is a revised edition of a handbook on the design, manufacture, and installation of electrical supply equipment. It contains the standards endorsed by 189 manufacturers in this field. These standards have been approved by the standards committee of the National Electrical Manufacturers' Association.

SMOOTH FINISH MACHINING OF LOW-CARBON, PLAIN, AND ALLOY STEELS. By J. S. Vanick and T. H. Wickenden. 20 pages, 6 by 9 inches. Distributed by the International Nickel Co., Inc., 67 Wall St., New York City.

This is a reprint of an article appearing in the Transactions of the American Society for Steel Treating, describing shop practice in obtaining a smooth finish on plain and alloy steels by avoiding the critical range in volume removal rates. Tables are included, showing the most satisfactory cutting speeds at which the lathe should be operated.

ROHE SCHRAUBEN. 220 pages, 6 by 8½ inches. Published by Bauer & Schaurte, Neuss, Germany.

This book contains a number of chapters relating to screw threads, gages, tolerances, and screw thread standardization, all of the chapters being in German except one on "Fundamental Principles of Screw Thread Standardization," which is printed in English, the author being Ralph E. Flanders, manager of the Jones & Lamson Machine Co., Springfield, Vt. This chapter contains an unusually clear and definite statement relating to the basic reasons for screw thread standardization.

THE SLIDE-RULE. By C. N. Pickworth. 130 pages, 5 by 7¼ inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 3 shillings, 6 pence, net.

This is the eighteenth revised edition of a practical little manual on the slide-rule. Many new slide-rules and calculators have been introduced during the last few years, and descriptions of these have been included in the present edition. An attempt has been made to group separately the slide-rules that facilitate the carrying out of the usual mathematical operations and those designed to deal with specific calculations.

A. S. T. M. TENTATIVE STANDARDS (1927). 824 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price: paper-bound, $7; cloth-bound, $8.

This is the 1927 edition of a book of A. S. T. M. tentative standards, issued annually by the association. The present volume contains 175 tentative standards, relating to ferrous metals; non-ferrous metals; cement, lime, gypsum, and clay products; preservative coatings and petroleum products; road materials; waterproofing and roofing materials; rubber products, insulating materials, and textile materials; and coal, coke, timber, and miscellaneous materials.

STEEL AND ITS HEAT-TREATMENT. By D. K. Bullens. 564 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $5.

This is the third edition of a book on the heat-treatment of steel, covering every aspect of modern heat-treating practice. It divides the subject into three parts, namely, the metallurgical phase, dealing with the general underlying principles and practices of heat-treatment processes; the engineering phase, pointing out the peculiar qualities of the various alloy steels; and the production phase, relating to industrial heating as applied to heat-treating processes. This edition contains several new chapters covering the recent advances that have been made in metallurgical science and in the art of heat-treating steel.

PERSONNEL. By George R. Hulverson. 400 pages, 6 by 8½ inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

This is the second of a new group of volumes on business administration, the present book describing the handling of the personnel activities of a business. While the objectives and operating technique of the work are treated in detail, the problem of general administrative control is kept in the foreground. An effort has been made to summarize the principal features of the best-known methods of personnel administration and the limitations that should be borne in mind in applying them. Only principles and methods that apply broadly have been presented. In the treatment of employment procedure, attention has been directed to job analysis and a study of the sources of the labor supply, as well as to methods of interviewing, testing, and selecting applicants. The handling and improvement of the working force after employment has also been considered, the discussion including practicable methods for adjusting rates, stimulus of efficiency through systematic training, and provision for adequate records and statistical control.

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1927-1928). 4500 pages, 9½ by 12 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, $15.

The eighteenth edition of this well-known reference guide for buyers follows the same arrangement as previous editions. The alphabetical index or finding list cover 180 pages. The classified list, covering all kinds of products made by American manufacturers, contains a list of the products arranged alphabetically, together with the names and addresses of the manufacturers. This, the main section of the book, contains 3486 pages. The third section of the book, containing an alphabetical list of the manufacturers and their addresses, contains 466 pages. This section is followed by an alphabetical list of the trade names of the products included in the classified section, containing 368 pages. The various sections are printed on different colored paper, so that they can readily be distinguished. In addition to the four main sections of the book the appendix contains a list of representative banks; boards of trade, chambers of commerce, and similar commercial organizations; trade papers; and trade associations. This book should be of great value not only to buyers but also to sales departments in compiling lists of names.

MECHANICS OF MACHINERY. By C. W. Ham and E. J. Crane. 504 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price, $4.

This book presents a discussion of the fundamental principles covering the inertia forces in rapidly moving machine parts, and the principles by which the effects of these forces may be modified or eliminated. It has been the purpose of the authors to bring together in a condensed textbook just sufficient material to give the student a working knowledge of both the subject of mechanism and that of dynamics of machinery in the time ordinarily available for this work in an engineering curriculum. The book is divided into two parts; Part I—on mechanism—is intended to bring to the attention of the student the fundamental mechanisms and the theory of their operation, and to give some idea of the scope of this division of the subject. It covers linkwork, cams, toothed gearing, bevel and screw gearing, belts, ropes, and chains, intermittent motion mechanisms, and trains of mechanisms. Part II—on kinematics and dynamics of machinery—is intended to enable the student to analyze the forces as well as the motions in the mechanisms or machines embraced under Part I.